DOCUMENT RESUME

ED 180 827 SE 029 699

AUTHOR Owens, Michael
TITLE Energy Education Curriculum Resource. Energy Education Workshop: Energy Sources of the Future.
INSTITUTION Education Service Center Region 7, Kilgore, Tex.
PUB DATE 79
NOTE 173p.; Page 55 removed due to copyright restrictions

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS Curriculum; *Curriculum Development; *Curriculum Guides; *Curriculum Research; *Elementary Secondary Education; *Energy; *Energy Conservation; Interdisciplinary Approach; Science Education; Secondary Education; Social Studies
IDENTIFIERS *Energy Education

ABSTRACT

This guide is designed to provide teachers with suggestions and assistance in equiping children as advocates of energy stewardship. It is divided into six discussion sections and one section dedicated to specific energy activities presented as curriculum guides for: (1) intermediate science, (2) high school science, (3) intermediate social studies, and (4) high school social studies. Discussion sections deal with energy education problems, energy education framework, energy saving, quick fix energy checklists, and Federal Energy Audits Grants. (Author/RE)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED180827

ENERGY EDUCATION WORKSHOP

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Michael Owens

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

1979—1980

Region VII Education Service Center
Kilgore, Texas

SE 029 699

ENERGY EDUCATION
Curriculum Resource

by

Michael Owens

Region VII Education
Service Center
P.O. Box 1622
Kilgore, Texas 75662

Don Peters
Executive Director

Henrietta Grooms
Associate Director

1979

TABLE OF CONTENTS

The Energy Education Problem.....1

Texas Energy Education Framework.....10

Energy Education Curriculum Guide For:

Intermediate Science.....29

High School Science.....57

Intermediate Social Studies.....79

High School Social Studies.....110

Principals Role in Energy Savings.....138

Quick Fix Energy Checklists.....142

Federal Energy Audits Grants.....162

Introduction

The concerns of society are focused on our energy supplies and consumption patterns by the restrictions of supply and rising costs. It is obvious the solution will come from a change in our primary source of energy as fossil fuels to other sources and a changed life style. The changes will be made by the school students of the 1980's for the new life style of the twenty-first century. These residents of the twenty-first century are our students of TODAY and their goals and values to accept a new life style must be a part of our curriculum. The solution for new energy sources and uses will come from our students and it is imperative we consider their needs. This document is directed to provide teachers suggestions and assistance in equiping children as advocates of energy stewardship.

Mike Owen
10-79

THE ENERGY EDUCATION PROBLEM:

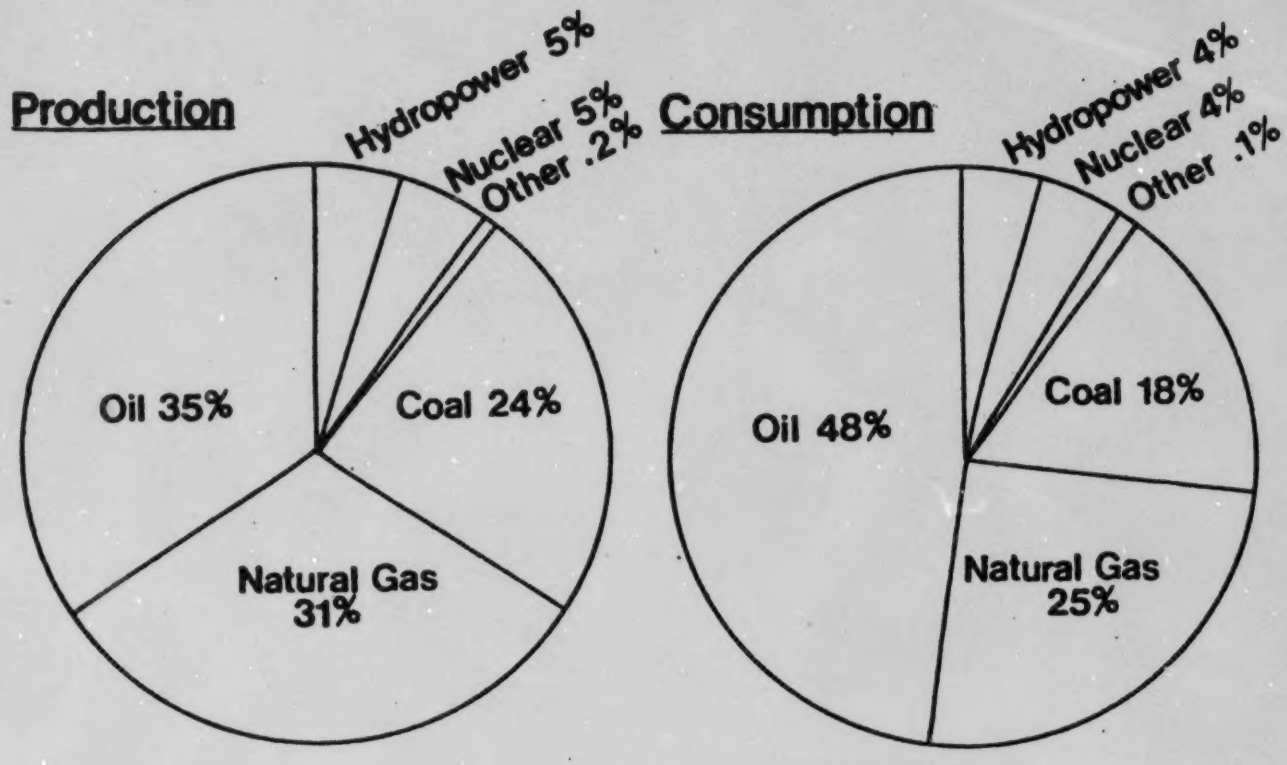
The National Energy Plan states the U.S. and the world are at the early stage of an energy transition. This transition springs from the need to adjust to scarcity and higher prices. (1) Unless the U.S. makes a timely adjustment before world oil becomes very scarce and very expensive in the 1980's the nation's economic security and the American way of life will be gravely endangered. (1)

Energy consumption and production data for 1978 are available and they indicate some changes in the U.S. energy consumption patterns. Overall domestic energy consumption increased from 76.6 QVtu in 1977 to 78.0 QBtu in 1978. This reflects an increase of 1.9% over 1977.

The distribution of this consumption has changed. In 1977, residential consumption accounted for 37.1% of the total U.S. energy consumption. In 1978, this figure increased to 37.6%. The transportation sector increased its share of the total, from 26.2% in 1977 to 26.4% in 1978. However, the industrial sector's percentage of the total decreased from 36.7 in 1977 to 36.1 in 1978.

When examining the total energy consumption figure by fuel, it can be noted that petroleum consumption as a percentage of the total, is down .1% from 1977, natural gas is down by .4% and coal is down by .4% (affected by 5% decline in production due to coal miners' strike).

On the other hand, hydropower and nuclear make up a larger percentage of the total consumption figure for 1978 than they did in 1977 (up .7 and .3 respectively). This is a result of increased levels of production in both areas. Petroleum imports decreased from 18.8 QBtu to 17.4 QBtu in 1978. (2)



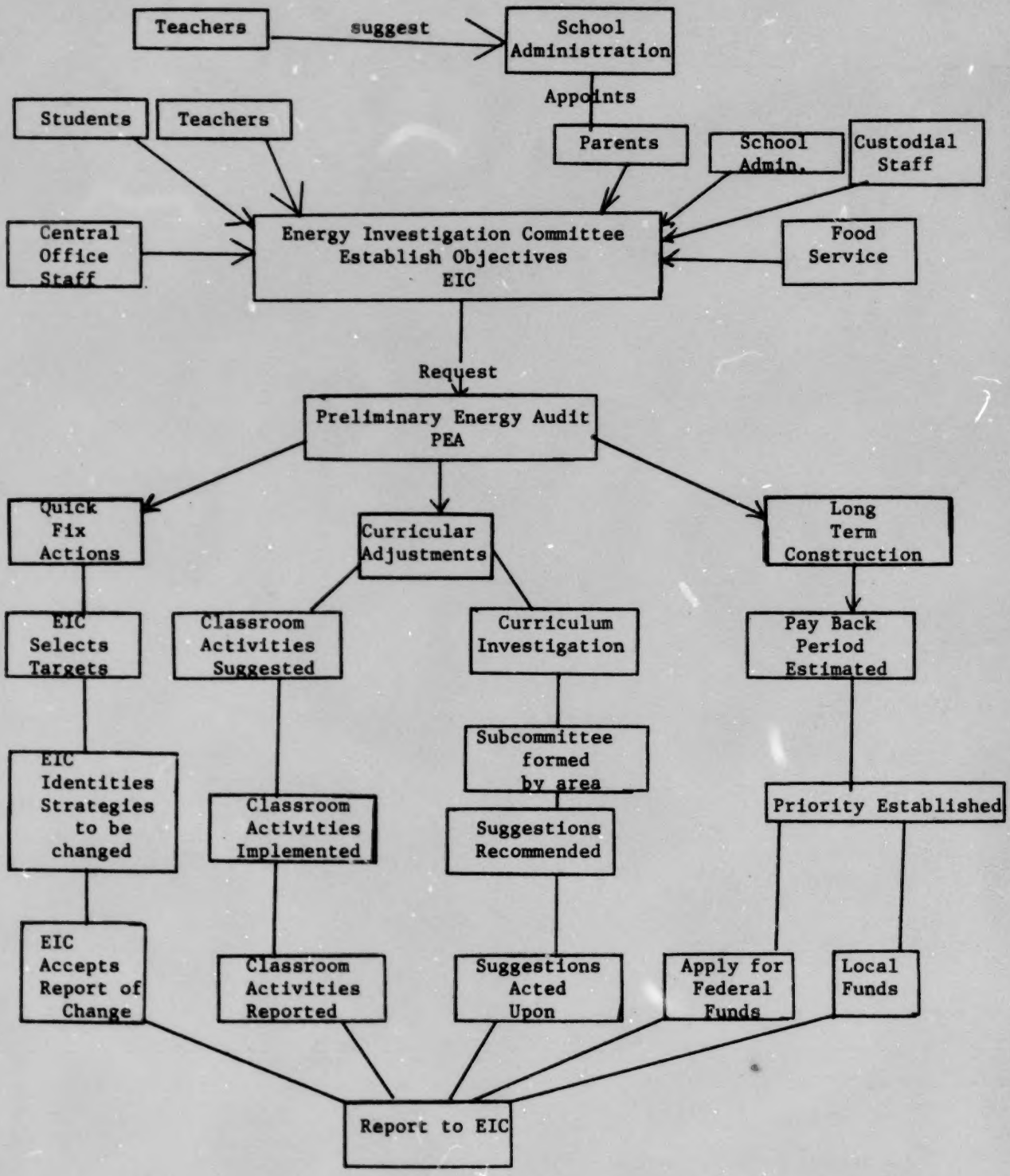
The president makes it clear that the rapid use of non-renewable energy sources is <u>not</u> a short term crisis but a long term situation that requires treatment of the cause. The long term (1000 years) solution will no doubt be electricity from solar or some other energy source. The interum solution while the oil barrel runs dry requires a modification by the classroom teacher to effect the changes that will result in a change of our current life style and a new energy use ethic. The old quick fix solution of add a module or a three week unit on energy has not been effective in creating the changes in life style restricted energy sources will create. It is now the responsibility of the teacher to again take a leadership role in helping the school become an energy laboratory to model the most effective energy saving behavior.

The teachers are faced with several problems relative to the range of information available and the possible actions teachers may take. In considering information resources the teacher must overcome the credibility gap developed by the energy producers past treatment of the general public. The three major sources of information relative to energy use, production and distribution are the government, oil companies and electric companies. It is clear that the conflicting data from these sources will require the teacher to be flexible in giving absolute answers to energy use and production questions. The teacher must help children explore a vast array of resources, current magazines, historical sources, government publications and forcast data to identify reliable information. The amount of information is vast but its specific relevence is limited.

The second problem is the establishment of the school as an energy laboratory. Borrowing frcm the past success in World War II where the school became a focus for community efforts to meet critical shortage needs. It is clear that the school is needed again. The establishment of an effective energy laboratory requires the full participation of all participants in the school. This is accomplished by the following flow chart. (Page 4)

The energy laboratory model flow chart outlines the critical need for an Energy investigation committee EIC established for each school building. It is entirely possible that every school district could establish a district wide group but to truly meet the need for changes in options by students, it is important that a committee be established in each building. The School as an energy laboratory allows the teachers to integrate the curriculum activities with the overall goals of the EIC. The teachers must use students as a resource in identification of the alternative method of actions that will result in less energy

Model for Energy Laboratory



consumed by the nation as a whole. The dynamics of the energy web require critical study of the total energy consumption matrix. A simple plan to eleminate evening athletics may result in less energy use at school but with more people staying at home during that time there may be a net energy use incease. Students are capable of accepting these challenges in redirecting the educational activities they are involved in. The school must become an energy laboratory if with the responsibilities for helping the community at large identify effective methods of energy conservation over the entire realm of energy sources. A model energy laboratory plan involves the following steps:

1. A school wide steering committee composed of students, teachers, custodians, cafeteria workers and Administrators.
2. Have a Preliminary Energy Audit (PEA) of each building conducted consistant with the D.O.E. regulations for P.E.A.'s.
3. Identify Quick Fix suggestions to save from each committee member. A brainstorming session can accomplish this. If you feel there is not enough background in the committee, consider free circulars available from the local electric and gas utilities, the D.O.E. materials available from the Associated Universities at Oak Ridge, Tennessee or the National Science Teachers Association. A variety of films are available that provide many Quick Fix ideas.
4. Have the committee take charge and develop an implementation plan of the Quick Fix suggestions. Make sure a balance exists between suggestions that cost money eg. repair broken windows & install weather stripping on doors with no cost ideas like making sure return air vents are not blocked and thermostats are not obstructed.
5. Real support by the major school administration is critical at this

point. The school administrator must help supplement the suggested changes and draw attention to the contributions of the committee. Positive rewards to the student body for complying with the new life style must be built into the system.

6. Continuous support must exist along with random emphasis of the energy activities.

The school must involve all the constituents to truly serve as a leader in energy resource conservation. This workshop is designed to assist school educators in identifying instructional strategies that will assure the curriculum relfects the changes in energy resources and information about energy auidts and the efforts available to assist schools in quick fix energy conservation measures and securing funds for energy and conservation measures.

WHAT IS YOUR ENERGY QUOTIENT? (EQ)

1. Major fuel supplies are derived from what type of fuels?

   _____

2. What are the three (3) principal fossil fuels?

   A._____ B._____ C._____

3. Which of the fossil fuels is most abundant in Texas? _____

4. Which fossil fuel is the principal one not being completely utilized in the United States? _____

5. Name three (3) non-fossil sources of energy. A._____

   B._____ C._____

6. What significant energy related event occurred in October, 1973?

   _____

   _____

7. What two energy demands combined take over half of the average American family's energy budget? A._____

   B._____

8. Name two (2) options for meeting our energy demand.

   A._____

   B._____

9. What two energy conversion processes may ultimately create the biggest new market for coal? _____

   _____

10. Name five (5) possible future sources of energy. A._____

    B._____ C._____

    D._____ E._____

11. What is the basic source of all energy? _____

12. What is OPEC? _____ _____

_____ _____

13. What is the nuclear reaction called that describes the <u>combining</u> of atomic particles or elements? _____

14. The study of energy belongs in what subject area in the schools?

_____

15. Hydroelectric power produces what percentage of the nation's total electrical energy? _____%

ANSWERS TO ENERGY QUOTIENT (EQ) QUESTIONS

1. Fossil Fuels

2. Petroleum, Natural gas, Coal

3. Petroleum

4. Coal

5. Sun Wind Falling Water Tides Plants Animals Muscles (Any three)

6. Saudi Arabia placed an embargo on the exportation of petroleum which resulted in a world-wide increase in the price of oil.

7. Automobile Space Heating

8. Import more fuel Reduce consumption Intensify exploration
More efficient ways to recover fuel resources Discovery of new sources
Conversion (Any two)

9. Gasification Liquification

10. Hydropower Solar radiation Winds Tides Geothermal sources

11. The sun

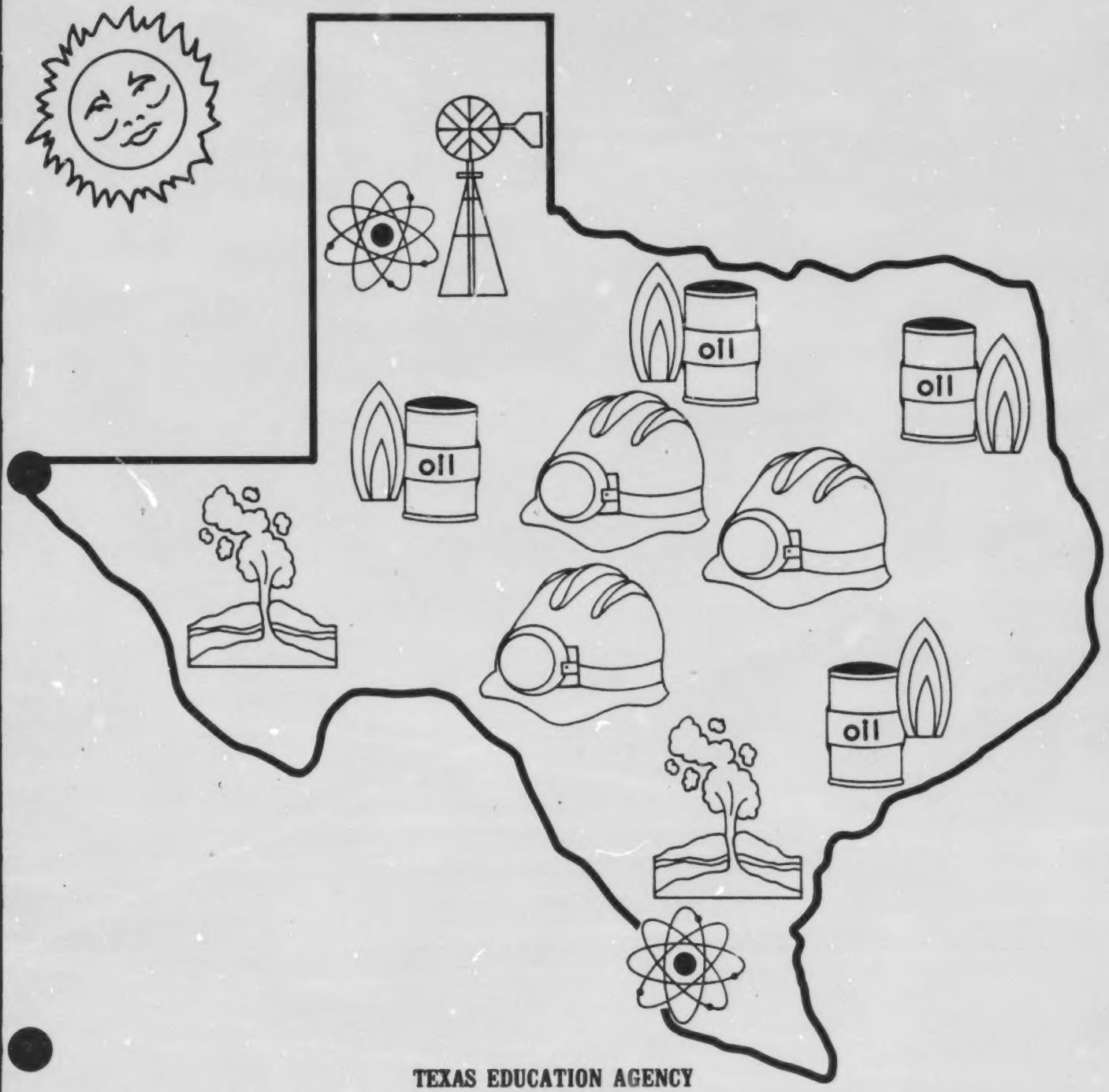
12. Organization of Petroleum Exporting Countries

13. Fusion

14. All or any

15. 4% and declining

TEXAS ENERGY EDUCATION FRAMEWORK



TEXAS EDUCATION AGENCY
AUSTIN, TEXAS
1979

FOREWORD

The *Texas Energy Education Framework* is designed to assist teachers, administrators, and other school personnel in the process of infusing energy education concepts into the public school curriculum. The *Framework* focuses on the basic concerns and needs of people as related to energy and suggests ways in which energy conservation can become a meaningful part of all disciplines in elementary and secondary schools.

We hope that the *Framework* will be a useful tool in helping young people become more aware of the critical decisions which we all face in meeting the present and future energy needs of our state and nation. The future of our society will depend in large measure on the thoughtfulness and wisdom of these decisions.

M.L. Brockette
Commissioner of Education

ACKNOWLEDGMENTS

ENERGY EDUCATION FRAMEWORK WRITING COMMITTEE

Betty Elvin
Science Teacher
Coldspring-Oakhurst Independent School District

Bill Holifield
Assistant Superintendent of Instruction
Plano Independent School District

Connie McQueen
Elementary Teacher
Temple Independent School District

Mike Owens
Consultant, Instruction
Region VII Education Service Center, Kilgore

Robert Reeves
Division Director, Special Services
Region I Education Service Center, Edinburg

Gail Riley
Social Studies Teacher
Hurst-Euless-Bedford Independent School District

Joseph Strehle
Director, Development and Resources
Region IV Education Service Center, Houston

CONTENTS

	Page
Rationale	1
Goals	2
Description of the Energy Education Matrix	2
Energy Education Matrix	4
Introduction to Matrices K-3, 4-6, 6-8, 9-12	5
Grades K-3 Matrix	6
Grades K-3 Energy Education Activities	7
Grades 4-6 Matrix	8
Grades 4-6 Energy Education Activities	9
Grades 6-8 Matrix	10
Grades 6-8 Energy Education Activities	11
Grades 9-12 Matrix	12
Grades 9-12 Energy Education Activities	13

RATIONALE

The State of Texas assumes a position of national leadership in agricultural and industrial development. Its bounty of natural resources and variety of terrain and climate attract people from throughout the world. Texas' population is more than double that of the last decade. Texas citizens, like those across the nation, are enjoying the benefits of rapid technological development; life is becoming more comfortable, safe, and rewarding. These are very positive developments in which the people of Texas can take justifiable pride. Hard work and creative thinking, indeed, produce the "good life" in our state. Unfortunately, these same factors of rapid population growth and technological developments result in greater and greater demands on our state and national supply of energy. We are consuming energy faster than the supply is being replenished. The shortage is becoming more critical, and society depends on current and future decisions we make regarding our use of energy resources. Energy conservation is a most critical world, national, state, community, and personal priority.

Few people take issue with the fact that conservation of energy is essential. What is planned, developed, and accomplished in the area of energy conservation is the collective result of the individual efforts of Texas people. One person cannot even address a problem of this magnitude, let alone work out a solution. Each person can only react to the problem as it affects his or her personal life. There are certain basic concerns of people which relate directly to the quality of life they can expect to have. When people realize that the future availability of energy directly affects their personal health, ability to work, and ability to enjoy the fruits of their labor, they begin to take action.

This framework for energy education in Texas schools is designed to address the problem of energy consumption from the standpoint of each individual and to suggest the effect which wise use of energy can have on the quality of life. The basic concerns of all people include personal health and well-being, career choice and development, consumer activity, enjoyment of leisure time, and a satisfying role in society. This framework demonstrates how each person's use of energy directly affects these basic concerns. For example, a diminished supply of energy directly impacts the consumer. The price of gasoline continues to rise, thereby causing each person to spend a greater proportion of personal income on fuel. It also causes local shortages which restrict travel, spoil vacation plans, and even affect employment and home location. There are steps which each person can take to moderate the use of gasoline and therefore avoid family budget problems and inconveniences which a critical shortage would produce. This framework systematically addresses individual problems and focuses on the questions: "How can energy conservation affect me, and how will alternative energy resources affect me in the future?"

An effort is made to relate the basic concerns of people to experiences which they have as elementary school students, middle school students, and young adults in the high school. People of all ages have concerns related to personal health and well-being, career choice or development, recreation, money supply, and social interaction. The framework directs attention to these concerns and to the relationship of individual use of energy. The concepts, applications, and values are outlined in a K-Grade 12 continuum which is designed for infusion into the regular curriculum offerings of the school.

GOALS

The student will:

- Help to make conservation of energy a national, state, community, and personal priority
- Become aware of one's role as a consumer and conserver of energy
- Be familiar with the various types of energy and how they can be changed from one form to another
- Be familiar with the major career opportunities in the energy field
- Understand the legal/social implications in the production and use of various types of energy
- Understand the environmental and economic impact of the use of energy and the effect which this may have on each person's life style
- Understand the effect of energy production on the Texas economy

DESCRIPTION OF THE ENERGY EDUCATION MATRIX

The following Energy Education Matrix serves as a basis for formulation of the Texas Energy Education Framework. It is designed to ensure the development of learning activities directly related to the personal concerns of people. The basic concerns of people listed on the horizontal axis are:

- Consumer Behavior
- Personal Health and Well-being
- Career Choice and Development
- Leisure Time and Recreational Activity
- Social-Legal Interaction of People

It is assumed that students will need learning experiences in three basic dimensions which relate energy education to these personal concerns. These dimensions listed on the vertical axis of the Matrix are:

- Knowledge (Concepts)
- Applications of Knowledge (Activities)
- Values and Attitudes

The interaction of the basic concerns of people (horizontal axis) and the dimensions of learning (vertical axis) create 15 instructional development cells. For example, in Cell One, the interaction of personal consumer concern and content knowledge creates a base for design of learning content related to consumer behavior. Such topics as the relationship between energy supply and price, wise shopping for energy-efficient appliances, the effect of energy shortage on the quality of goods and services, the relationship to personal comfort, the cost effectiveness concept, and selection of clothing for different seasons could be developed using this cell as a planning base.

Cell Eight, created by the interaction of educational applications as related to career concerns of people, creates a planning base for student understanding of how changes in energy supply will affect job opportunities in future years. For example, the student will be able to see how new sources of energy such as wind, solar, and geothermal, will offer new career opportunities. Such concepts as the effect of energy shortage on the recreational industry, on new energy forms related to engineering job opportunities, and on applications of solar energy (including opportunities for development of extra-terrestrial collectors) would be included. The career opportunities exploration and selection process will undergo tremendous change in application during the coming years. All phases of curriculum should reflect not only changes in job opportunities but the need for early exploration, planning, and proper training for the world of work in the future. This cell, like all others, is only intended as a springboard in the area of curriculum planning and by no means presents all of the possible applications.

USE OF ENERGY EDUCATION CHARTS

The following charts present an array of examples delineating the kinds of learning experiences that could be designed using each of the 15 cells as a planning base. The curriculum designer or teacher can, from this kind of base, delineate a multitude of learning activities for each cell as they relate to science and social studies as well as to all other disciplines. The basic concepts and educational programs which follow are all based on the use of this Energy Education Matrix as a planning base. Items included, such as descriptors in the Matrix, are by no means all inclusive but only represent examples of the kinds of learning experiences that can be infused into all phases of the elementary and secondary school curriculum.

ENERGY EDUCATION MATRIX

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	(1) Knowledge of energy conservation affects consumer behavior.	(2) Individual health and well-being are directly affected by energy use.	(3) Changing patterns of energy use and energy resources affect career opportunities now and in the future.	(4) Energy shortages and changing patterns of use affect the recreational activities of all people.	(5) Changing patterns of energy consumption and energy regulations affect individual lifestyle and the world society.
Application	(6) Applications of consumer knowledge relate to energy conservation.	(7) Application of energy conservation techniques improves individual health and well-being.	(8) Educational requirements for new jobs resulting from energy conservation and alternative resources are changing rapidly.	(9) Applications of information regarding wise use of energy affect the use of leisure time.	(10) Application of social-legal knowledge related to energy conservation and energy production affects the ability of each individual to live in harmony with other people of the world.
Values	(11) Consumer values affect the total use of energy.	(12) Personal values related to energy use affect the health and well-being of each individual.	(13) Career values and work ethics relate to the changing energy picture and job satisfaction.	(14) Personal values regarding the use of energy for recreation affect the total consumption of energy.	(15) Social and political values are directly related to availability of energy and influence its research, transportation, and consumption.

INTRODUCTION TO MATRICES K-GRADE 3, GRADES 4-6, GRADES 6-8, GRADES 9-12

The need for energy education is critical and should be infused at all instructional levels and in all subjects. Toward this end, matrices of instructional cells for energy education have been developed for Kindergarten through Grade 3, for Grades 4 to 6, for Grades 6 to 8, and for Grades 9 to 12. Although school communities have their own expectations and their own needs, the matrices seek to show common concerns in energy education. *The Framework for Energy Education* aims at infusing the concepts of energy education in the Kindergarten through Grade 12 curricula while enlisting all students and educators in the energy management team.

The matrices on pages 6, 8, 10, and 12 are examples of how the goals for energy education can be expanded to include objectives for classroom activities. The matrices are not comprehensive lists of the knowledge, applications, or values applicable to energy education. The teacher may use the matrices as guides in developing his or her instructional program.

The Energy Education Curriculum Planning Activities on page 7, 9, 11, and 13 illustrate how individual instructional cells of the matrices are applicable to a number of subjects. Teachers are urged to reflect on their instructional sequences and focus appropriate segments on energy education goals.

GRADES K-3 MATRIX

OBJECTIVES FOR ENERGY EDUCATION

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	The student will become aware that energy can be changed from one form to another.	The student will be aware of interdependence of energy use and personal comfort.	The student will be cognizant of energy uses in parents' jobs.	The student will be aware that the games we play use energy.	The student will become aware that our homes benefit from energy-efficient decisions.
Application	The student will be able to dramatize simple energy changes.	The student will recognize conditions which might affect heating and cooling devices.	The student will be aware that the nature of jobs changes with the source of energy used.	The student will be able to compare the relationship between physical motion and body heat.	The student will be aware of classroom rules that regulate classroom uses of energy.
Values	The student will determine ways to conserve energy at a personal level.	The student will realize one form of energy conservation is as simple as personal selection of clothing for each weather situation.	The student will determine how job choices affect the amount of energy use and how the community is affected.	The student will realize that there can be personal satisfaction in independent play without expending excessive energy.	The student will tolerate some degree of discomfort or loss of independence for the benefit of all.

→ SEE ENERGY EDUCATION ACTIVITIES EXAMPLE PAGE 7.

GRADES K-3 ENERGY EDUCATION ACTIVITIES

CAREER APPLICATION

THE STUDENT WILL BE AWARE THAT THE NATURE OF JOBS CHANGES WITH THE SOURCE OF ENERGY USED. The following activities illustrate how one instructional cell of the matrix is applicable to several subjects. This is not an exhaustive list of possible appropriate activities. The teacher should adapt these or other instructional activities to meet the particular needs of his or her students.

SUBJECT	CORRELATING ACTIVITIES
Language Arts and Social Studies	Students make a list of workers involved in building a house and indicate the use of energy in each of their jobs.
Science	Students interview workers who use alternative sources of energy in construction and ask how they increase home energy efficiency by using these different sources of energy.
Mathematics	Students compute the number of days different workers spend in building houses using energy-saving methods.
Art	Students make a mural showing the workers at various stages of building a house.
Music	Students make musical instruments from discarded building materials to develop an awareness of different sources of energy conservation.
Health	Students develop a simple dance in which they imitate the workers.
Reading	Students read stories related to construction with attention focused on the use of energy in the jobs of the workers.

GRADES 4-6 MATRIX
OBJECTIVES FOR ENERGY EDUCATION

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	The student will be aware that consumer decisions are usually directed by one's particular environment or culture.	The student will be aware that the sufficient supply of energy depends essentially on lifestyles and the wise use of natural resources.	The student will be aware that the field of energy offers major career opportunities and satisfying work experiences.	The student will be aware that the supply of world energy affects the way we use leisure time.	The student will be aware that the supply and use of energy are directly related to the world's economic and political well-being.
Application	The student will identify the usability span of different types of beverage containers and will recognize the role of energy in recycling.	The student will be aware of wasteful uses of energy at home and at school and will determine measures which increase the sufficient supply of energy.	The student will identify energy related jobs in society today.	The student will evaluate favorite recreational activities and determine the type of energy used.	The student will recognize that supply and use of energy have an impact on the community, state, nation, and world.
Values	The student will recognize cultural differences in energy use patterns.	The student will recognize how the use of energy affects individual well-being and the fate of generations to come.	The student will be aware of alternative energy resources that could be used to maintain the current lifestyle.	The student will understand how decisions, lifestyle, and leisure time affect energy efficiency.	The student will compare energy uses that are important only for personal comfort or convenience in the home and community.

SEE ENERGY EDUCATION ACTIVITIES EXAMPLE PAGE 9.

GRADES 4-6 ENERGY EDUCATION ACTIVITIES

INDIVIDUAL WELL-BEING AND KNOWLEDGE

THE STUDENT WILL BE AWARE THAT THE SUFFICIENT SUPPLY OF ENERGY IN THE UNITED STATES DEPENDS ESSENTIALLY ON LIFESTYLES AND THE WISE USE OF NATURAL RESOURCES. The following activities illustrate how one instructional cell of the Energy Concerns Matrix is applicable to several subjects. This is not an exhaustive list of possible appropriate activities. The teacher should adapt these or other instructional experiences to meet the particular needs of his or her students.

SUBJECT	CORRELATING ACTIVITIES
Language Arts	The class will compile a newspaper about energy sources and conservation. Include headlines, news stories, feature stories, editorials, letters to the editor, cartoons, and advertisements on energy sources and on how energy could be conserved. The writing of the editorials could be used as a class contest or expanded into a school-wide contest.
Spelling	Introduce the spelling of energy related words. Students participate in class or school "spelling bees."
Reading	Students write a simple poem about the wise use of energy or about alternative energy sources. Poems are read aloud to the reading group.
Mathematics	Students prepare a chart of temperatures in the classroom/school. Chart shows the monthly fuel cost.
Science	Students keep records of their use of electricity for one day, noting the purpose of each energy use and the ways energy could be conserved.
Social Studies	Students list items available for use in the home which are considered luxury items, convenience items, and necessity items and do a comparative study of costs in terms of energy usage.
Art	Students design logos and slogans that will inform people about the need to conserve energy. Students paint a mural using these logos and slogans. After securing permission from local merchants, students reproduce the mural on a store window to further public awareness of need for energy conservation.
Music	Students make a class collection of songs related to energy and learn to sing the songs. Using some of the songs they have learned, students write and produce a play to be presented for the student body.
Health	Students compare health problems of the United States to those of countries that have less energy available and determine the role of energy in providing good health care.

GRADES 6-8 MATRIX
OBJECTIVES FOR ENERGY EDUCATION

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	The student will be aware that energy is transformed with a loss of energy during each transformation.	The student will be aware of interdependence of energy use and personal comfort.	The student will be aware of various career opportunities involved in the transformation of energy from source to usable product.	The student will be aware of interdependency of energy use and personal comfort. →	The student will be aware that transformation of energy from source to usable product presents environmental and economic issues.
Application	The student will be cognizant of the forms of energy used to produce basic food groups.	The student will understand that temperatures vary over different surfaces, such as earth, plants, or fabrics.	The student will be aware of careers associated with energy transformation.	The student will relate favorite recreation activities to energy requirements of each.	The student will be able to identify uses of land and compare job opportunities and economic importance of each use.
Values	The student will understand the nutrition and energy economics of food groups.	The student will be aware of advantages and disadvantages of adjusting lifestyles to maximum energy efficiency.	The student will understand that career choices are affected by availability of energy or by alternative sources of energy.	The student will recognize personal satisfaction associated with favorite recreational activities in terms of energy cost.	The student will be aware of advantages and disadvantages of different land uses and of how the use of land affects choices people have.

→ SEE ENERGY EDUCATION ACTIVITIES EXAMPLE PAGE 11.

GRADES 6-8 ENERGY EDUCATION ACTIVITIES

SOCIO-LEGAL AND KNOWLEDGE

THE STUDENT IS AWARE THAT TRANSFORMATION OF ENERGY FROM SOURCE TO USABLE PRODUCT PRESENTS ENVIRONMENTAL AND ECONOMIC ISSUES. The following activities illustrate how one instructional cell of the Energy Concerns Matrix is applicable to several subjects. This is not an exhaustive list of possible appropriate activities. The teacher should adapt these or other instructional experiences to meet the particular needs of his or her students.

SUBJECT	CORRELATING ACTIVITIES
Language Arts	Students interview senior citizens and compare to the present the lifestyles and economic and environmental problems of earlier days when energy use was not as limited. Students interview senior citizens to determine what alternative energy sources were used before present-day energy sources were available.
Social Studies	Students investigate the environmental and economic impact on the community of the use of various types of energy.
Science	Students design an experiment to change energy from one form to another.
Health	Students compare types of current health problems of the community with health problems of earlier days when energy use was a fraction of present use.
Mathematics	Students plot the economic value of energy produced and the cost of dealing with environmental problems incurred.
Art	Students make a diorama of events in earth history that have caused resources to be concentrated in certain locations.
Music	Students experiment with amounts of electrical energy required to produce sounds in various instruments and in amplifier systems.

GRADES 9-12 MATRIX
OBJECTIVES FOR ENERGY EDUCATION

	Consumer	Individual Well-Being	Career	Recreational	Socio-Legal
Knowledge	The student will understand that energy conservation and alternative energy sources will affect consumer behavior.	The student will be aware of the interdependence of personal well-being and comfort and energy consumption.	The student will understand that changing patterns of energy use and alternative sources of energy affect career opportunities now and in the future.	The student will be aware of how the availability of energy and efforts to conserve will affect recreation and lifestyle.	The student will understand that improved energy conservation practices and alternative sources will cause major changes in individual lifestyle and world society.
Application	The student will describe an energy-efficient home, car, school, and appliance.	The student will provide examples of how group and individual well-being are improved by energy conservation in areas of transportation, housing, and recreation.	The student will identify major changes which energy conservation practices or which alternative sources of energy will have on job opportunities in the major occupational clusters.	The student will list and compare energy efficient vs. inefficient recreational activities in the areas of travel, sports, hobbies, and home care.	The student will list major changes in law or social customs which have taken place in the areas of transportation, housing, and recreation as a result of energy shortage.
Values	The student will list the specific advantages and disadvantages of acquiring an energy-efficient home, car, or appliance.	The student will be able to understand the effects of energy-efficient decisions related to transportation, housing, and recreation on personal comfort and well-being.	The student will list the changes which have occurred in his or her parents' careers as a result of changing energy availability or sources and how this has affected their priorities in life.	The student will identify changes which have occurred and project future changes in his or her recreation lifestyle as a result of the current energy situation.	The student will be able to compare the present and projected laws and customs in the areas of transportation, housing, and recreation as a result of energy conservation practices.

→SEE ENERGY EDUCATION ACTIVITIES EXAMPLE PAGE 13.

GRADES 9-12 ENERGY EDUCATION ACTIVITIES

INDIVIDUAL WELL-BEING AND APPLICATION

THE STUDENT WILL PROVIDE EXAMPLES OF HOW GROUP AND INDIVIDUAL WELL-BEING ARE IMPROVED BY ENERGY CONSERVATION IN AREAS OF TRANSPORTATION, HOUSING, AND RECREATION. The following activities illustrate how one instructional cell of the Energy Concerns Matrix is applicable to several subjects. This is not an exhaustive list of possible appropriate activities. The teacher should adapt these or other instructional experiences to meet the particular needs of his or her students.

SUBJECT	CORRELATING ACTIVITIES
Language Arts and Language Learning	Students debate voluntary changes vs. governmental control as a necessity to make changes in energy consumption.
Social Studies	Students interview people who rode trains 30 years ago and people who have ridden trains recently and compare their experiences. Students debate the merits of mass transportation as an energy-saving method.
Science	Students place glass microscope slides covered with petroleum jelly in the exhaust of three different vehicles and compare the amounts of particulate matter expelled.
Health	Students predict the air pollution effect if no students drove cars to or from school.
Mathematics	Students design a scale to rate well-being of individuals riding in a vehicle and graph comparisons of different size cars.
Art	Students express one person's feelings about the need for energy conservation in areas of transportation, housing, and recreation.
Music	Students develop a rhythmic choral reading to compare the sound levels of different kinds of transportation.

COMPLIANCE STATEMENT

TITLE VI, CIVIL RIGHTS ACT OF 1964; THE MODIFIED COURT ORDER, CIVIL ACTION 5281, FEDERAL DISTRICT COURT, EASTERN DISTRICT OF TEXAS, TYLER DIVISION

Reviews of local education agencies pertaining to compliance with Title VI Civil Rights Act of 1964 and with specific requirements of the Modified Court Order, Civil Action No. 5281, Federal District Court, Eastern District of Texas, Tyler Division are conducted periodically by staff representatives of the Texas Education Agency. These reviews cover at least the following policies and practices:

(1) acceptance policies on student transfers from other school districts;

(2) operation of school bus routes or runs on a non-segregated basis;

(3) non-discrimination in extracurricular activities and the use of school facilities;

(4) non-discriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;

(5) enrollment and assignment of students without discrimination on the basis of race, color, or national origin;

(6) non-discriminatory practices relating to the use of a student's first language; and

(7) evidence of published procedures for hearing complaints and grievances.

In addition to conducting reviews, the Texas Education Agency staff representatives check complaints of discrimination made by a citizen or citizens residing in a school district where it is alleged discriminatory practices have occurred or are occurring.

Where a violation of Title VI of the Civil Rights Act is found, the findings are reported to the Office for Civil Rights, Department of Health, Education and Welfare.

If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

SECTION 504, REHABILITATION ACT OF 1973; EDUCATION OF THE HANDICAPPED ACT (P.L. 94-142)

No qualified handicapped person will, on the basis of handicap, be excluded from participation in, be denied the benefits of, or otherwise be subject to discrimination under any program or activity operated by the Texas Education Agency. The Texas Education Agency makes positive efforts to employ and advance in employment qualified handicapped individuals.

TITLE IX, CIVIL RIGHTS ACT OF 1964

No person shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity operated by the Texas Education Agency.

PREPARATION FOR CLASSROOM IMPLEMENTATION

The information you will complete on this form will assist you in providing instruction related to the concepts. You may wish to use this form for additional concepts.

CONCEPT CLUSTER_____ CONCEPT NO._____

CONCEPT_____

_____

IMPLEMENTATION:

I plan to teach this concept at the_____grade level(s). The subject area(s) I plan to use are_____

Two activities I plan to use are:

(1) _____

_____

_____

(2) _____

_____

_____

COMMENTS: _____

_____

_____

_____

_____

TABLE OF CONTENTS

ENERGY CONCEPT (Teaching Skill)

OBJECTIVE: page #

CONSUMER KNOWLEDGE (Developing Concepts)

The student will be aware that consumer decisions are directed by one's particular environment of culture.....1

CONSUMER APPLICATION (Comparisons)

The student will identify the usability span of four types of beverage containers..... 6

CONSUMER VALUES (Collecting Pictures)

The student will discuss cultural differences in energy use patterns..... 8

INDIVIDUAL WELL-BEING KNOWLEDGE (Discussions)

The student will be aware that the sufficient supply of energy depends essentially on lifestyles and the wise use of natural resources..... 9

INDIVIDUAL WELL-BEING APPLICATION (Reading for Meaning)

The student will be aware of wasteful uses of energy at home and at school and will be able to determine measures which increase the sufficient supply of energy..... 12

INDIVIDUAL WELL-BEING VALUES (Research)

The student will discuss how the use of energy affects individual well-being and the fact of generations to come..... 15

CAREER KNOWLEDGE (Career Interests)

The student will be aware that the field of energy offers major career opportunities and satisfying work experiences..... 16

CAREER APPLICATION (Group Work)

The student will identify energy related jobs in society today.....17

CAREER VALUES (Research)

The student will discuss the types of tasks performed in the energy field..... 18

RECREATIONAL KNOWLEDGE (Decision Making)

The student will be aware that the supply of world energy affects the way we use leisure time..... 19

RECREATIONAL APPLICATION (Exploration)

The student will list five recreational activities and determine the type of energy used by each.....20

RECREATIONAL VALUES (Problem Solving)

The student will discuss how decisions, lifestyles, and leisure time affects energy efficiency. 21

SOCIO-LEGAL KNOWLEDGE (Debates)

The student will be aware that the supply and use of energy is directly related to the world's economic and political well-being.....22

SOCIO-LEGAL APPLICATION (Using the Newspaper)

The student will maintain a file of newspaper clippings and magazine articles related to the supply and use of energy to determine the impact on their community, state, nation, and the world.....24

SOCIO -LEGAL VALUES (Comparisons)

The student will compare energy uses in their home and community..... 26

CONCEPT: CONSUMER KNOWLEDGE

OBJECTIVE: The student will be aware that consumer decisions are directed by one's particular environment or culture.

ACTIVITY: DEVELOPING CONCEPTS

The weather or climate, has an effect in determining one's environment. In some parts of the world the weather is very hot. Another part of the world is cold the year round. In temperate zones the winter, though mild will be cold enough to require heating devices. The summers in the temperate zone will be moderately warm. The use and kinds of energy in these countries will vary. Some areas will be near electrical power, some near oil fields and others near coal veins. Far nothern countries sometimes have oil piped to their areas.

In terms of hot and cold weather complete the chart below listing the types of heating, the raw materials that are used, the types of heating devices that are used, and if the raw material is near the area of consumption.

Use the chart on the following page.

Place	Type of Heat	Cooling Method	Natural Resources Used	Available in this area
West Virginia	Forced Hot Air-Radiator	Fans	Coal Water power	Yes
Texas				
Alaska				
Hawaii				
Washington				
Florida				
Maine				
Nebraska				
Canada				

ACITIVITY II

READING FOR INFORMATION

NYTHS ABOUT SOLAR ENERGY

There are several myths about solar energy that n need to be dispelled.

(1) It is new technology, a new space age technology. Actually, there were 50,000 solar hot water heaters in Miami in the 1950's.

(2) It only works in the South. Actually, we have anti-freeze systems that work very well in the north.

(3) If you wait around, it will go down in price. The truth is, the systems are actually going up in price. They won't fo down until the price of automobiles, materials or labor goes down. Unlike the electronic industry, solar energy cannot be miniaturized. It's a diffusdd form of energy, you have to spread out a certain amount of materials to capture it.

(4) The technology will change soon radically. That is not true because the systems we have today operate on the same principle as was used in the 20's, with flat plate collectors.

Solar heating is defined as a "mature technology with no imminent technolgical breakthrough". The generation of electricity with solar cells is a future technology and very expensive. It is not likely that solar cells will ever be used to provide heat.

Advice to consumers about choosing a solar system:

(1) Make sure the engineering behind the system is correct. This means that the size of the collectors, the size in storage, the flow rate of the pump or fan and the setting of the controller all work well together.

(2) The manufactured product must be well constructed, reliable with at least a five-year warranty on the whole system.

(3) The installation must be correct by trained installers.

The homeowner should be aware that the building itself can function effectively in relation to the sun. South windows can be solar collectors but should be snuggly covered at night. The mass of the building can store heat or keep a house cool. Landscaping can be planned for wind protection , shade or solar gain.

Technology on solar energy will soon change. Consumers need to know three important facts if they are thinking about installing a solar system in their homes. What are these three facts to be considered? Discuss each in a report with the class.

ACTIVITY III Sentence Completion

COMPLETE EACH OF THE FOLLOWING SENTENCES:

(1) All power is initially derived from the_____.

a, earth b. sun c. weather d. none

(2) The world's resources which go into the production of energy are _____.

a. renewable, thus infinite

b. limited, or finite because the forces which create those resources are so slow they can be considered non-renewable

c. limited, but so plentiful at the time that concern is unwarranted.

(3) The increased production of goods and services resulting from the increased use of our resources has caused _____problems.

a. economic b. social c. environmental

d. political

(4) To maintain a comfortable lifestyle in this technological society of today, we must adapt the principle of _____.

a. socialization b. capitalism c. conservation

d. idealism

(5) Of the following which is not a term for oil?

a. petroleum b. crude c. geothermal d. black gold

(6) It has been said that the world has ample mineral wealth and that we need only new technologies to exploit this wealth. This argument neglects the fact that it requires_____to transform raw materials into products and to create more_____.

a. refining b. manufacturing c. energy d. resources

CONCEPT: CONSUMER APPLICATION

OBJECTIVE: The student will identify the span of four types of beverage containers.

ACTIVITY: MAKING COMPARISONS

Some beverage containers will be made of waxed cardboard like the milk cartons in the lunch room cafeteria. They are easy to open and good for cold drinks.

All-aluminum beverage containers are in wide spread use. These cans are light weight, have no noticable seam down the side, and are recyclable materials. The beer industry is a big user of all aluminum cans. Two states in the United States have passed a law that all beverage containers must be recyclable. Other states are working on similar regulations.

Bi-metal cans are recyclable but the process is more costly and these cans unlike all aluminum cans will rust. This is a heavier container and some of the metal used is cheaper than aluminum. Coca Cola uses this can. One reason it is used by some beverage companies is because it can be stacked in greater quantities because it is sturdier and heavier. Tri-metal cans are even used by some companies because of availability of materials.

Glass beverage containers can be used over and over. The materials in glass containers are readily available in some areas. The broken bottles can be recycled.

COMPLETE THE CHART ON THE NEXT PAGE.

	Materials used in container	Source of aterials	Is the can ecyclable	length of time used
Paper Container				
Glass Bottles				
Aluminum Cans				
Bi-metals Cans				

CONCEPT: CONSUMER VALUES

OBJECTIVE: The student will discuss cultural differences in energy use patterns.

ACTIVITY: COLLECTING PICTURES

Culture is defined as the customary beliefs, social forms, and material traits of a racial, religious or social group. How does the advancement made by science influence a culture? How does the use of energy vary from one culture to another? How has science played a role in these different cultures?

In a highly technological area energy use is on a much larger scale and of a very complex nature. A large metropolitan area will have massive electrical power plants and substations that use many metals, large dynamos, and complex equipment and machinery. An amazing amount of energy will be used every day in homes and industries of such an area. Many fields of science will work together to produce energy from oil and water. Much human industry will be involved.

In a rural area a simple windmill or water wheel will produce energy for maybe only one house. Life, in general, will be much more simple than in a large city.

COLLECT PICTURES OF ENERGY USES OR ENERGY PRODUCTION IN DIFFERENT COUNTRIES AND IN RURAL AND URBAN AREAS.

CONCEPT: INDIVIDUAL WELL-BEING KNOWLEDGE

OBJECTIVE: The student will be aware that the sufficient supply of energy depends essentially on lifestyles and the wise use of natural resources.

ACTIVITY: DISCUSSION

How does our country differ from others in lifestyles and energy consumption?

The United States is considered one on the most affluent countries in the world. Technology is largely responsible for this affluence. Science has made advancements over the years that has assured American citizens of comforts and well-being. Oil, water, gas and electricity heats and cools homes, offices and industries.

List natural resources that are energy producers and give locations of where they are found in the United States.

Natural Resources	Location in the United States

ACTIVITY II

PETROLEUM CONSERVATION

Petroleum is so valuable it is often called "black gold". When it comes from the ground it is a black liquid. This liquid can be refined into hundreds of useful products that we use every day.

Some fuels that come from petroleum are ink, print, wax, detergents, rubber tires, and cleaning fluid.

ASK STUDENTS TO FIND THE ANSWERS TO THE FOLLOWING:

1. How many oil wells are located in the United States?
2. How much oil will each well average?
3. Which country uses the most oil?

USE WORDS FROM THE LIST BELOW TO COMPLETE EACH SENTENCE.

1. Petroleum is an _____ resource.
2. Another name for petroleum is _____.
3. Petroleum is a _____ fuel. It took millions of years to form petroleum.
4. Scientists know how to read signs on _____ when looking for oil.

WORD LIST:

GOLD	ROCKS	NON RENEWABLE	WAX
FOSSIL	MEDICINE	PLASTIC	

ACTIVITY III

RESEARCH

A recent newspaper article had a headline which read "THE WEALTHY ARE MORE CONSERVATIVE IN ENERGY USE" The article explained that education is the reason. Educated people work in higher paying jobs. Education has taught these people that energy supplies are limited and conservation is necessary for future well-being.

All people need to be aware of renewable and non-renewable resources. A sense of well-being can be established if one can be convinced of future comforts. Energy will be the key to these comforts. Wise use of non-renewable resources and knowledge of how renewable resources are "reused" will assure future energy supplies:

COMPLETE THE CHART BELOW BY LISTING SOURCES OF ENERGY AND THEN INDICATING IF THEY ARE RENEWABLE OR NOT:

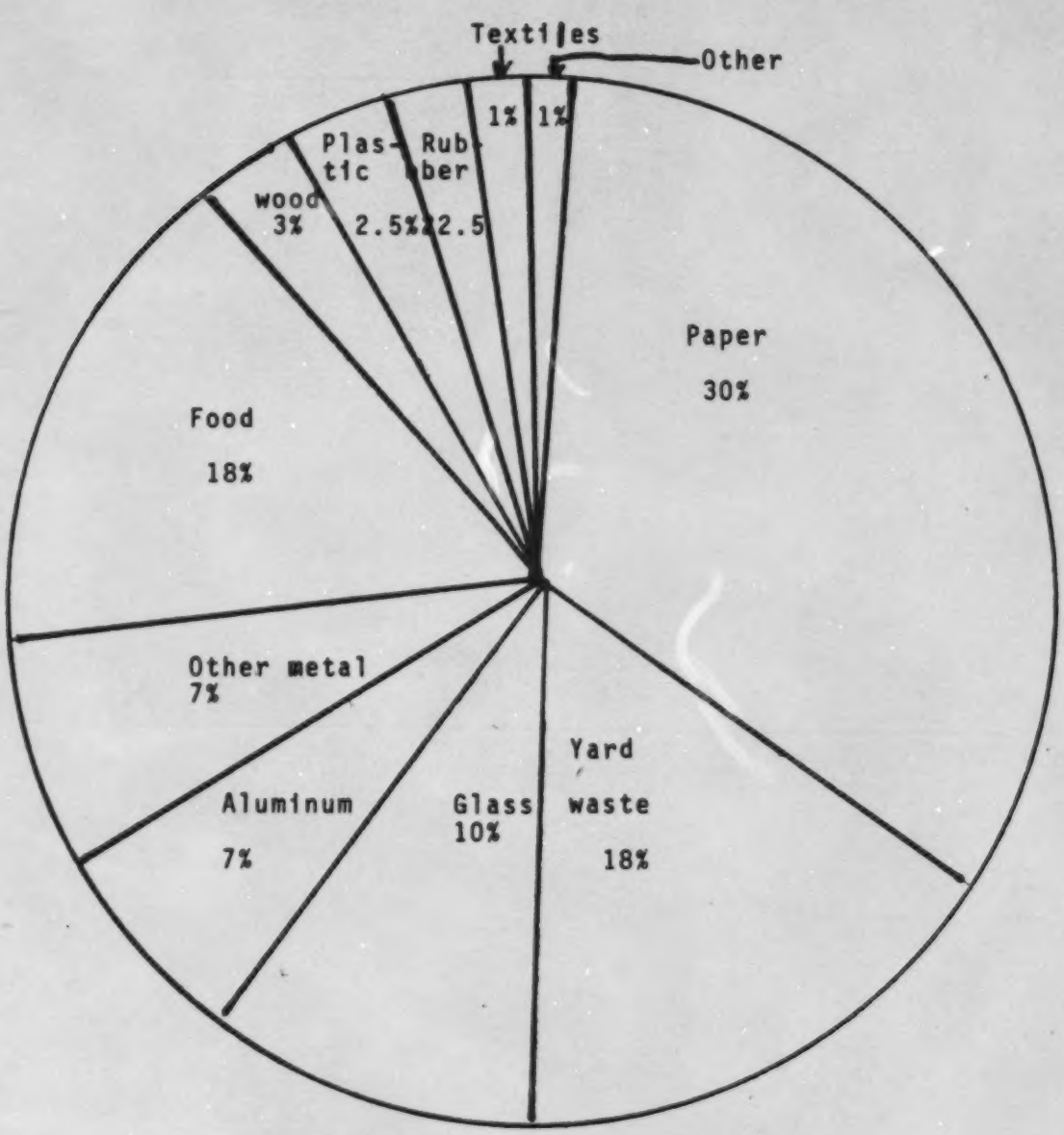
ENERGY SOURCE	Renewable	Non-renewable

ACTIVITY I

Discussions

Every American "produces" from 3 to 4 pounds of trash

Study the graph below and discuss what the country's trash consists of:



ACTIVITY II

Make a chart showing how much electricity your family uses at home for one day - for one week. Learn to read an electric meter:

When reading the dials read from the right to the left. Copy the numbers in the same order. If the indicator lies between two numbers, record the number just passed. This number will always be the smaller number. The number from the meter reading above should be 13488.

Call your lighting and power or electric company and ask the cost per kilowatt/ hours (Kwh)

COMPLETE THE CHART BELOW:

Day	Kilowatt/hours used	Cost

Cost for the week _____

ACTIVITY

PUTTING KNOWLEDGE INTO ACTION

1. Have the students go to each classroom and ask the teacher is she/he is using the electric lights during the day? Ask if she/he could use only natural light most of these hours.

2. Check to see how many rooms leave windows and doors open when the air conditioners are on.

3. Ask school personnel what electric bill for your school is for one month. Ask how your school compares with other schools your size.

4. Make a list of ways to conserve electricity at home and at school.

5. What measures - such as insulation, using natural light and others, can be taken to conserve energy?

6. Do the same activities with the use of gas and water.

CONCEPT: INDIVIDUAL WELL-BEING VALUES

OBJECTIVE: The student will discuss how the use of energy affects individual well-being and the future of generations to come.

ACTIVITY: RESEARCH

The standard of living or well-being can be defined as the way of living that people or a community, considers essential to provide enough material things for happiness and comfort.

Energy plays a most important role in an individual's well-being. Food is needed for human energy; natural resources are needed for comfort and travel.

New energy sources for the years 1985 - 2000 include:

synthetic fuels (from oil and coal)	shale oil
breeder reactor	geothermal power
solar power	biomass
wind power	nuclear power

Draw charts that will show how power is produced.

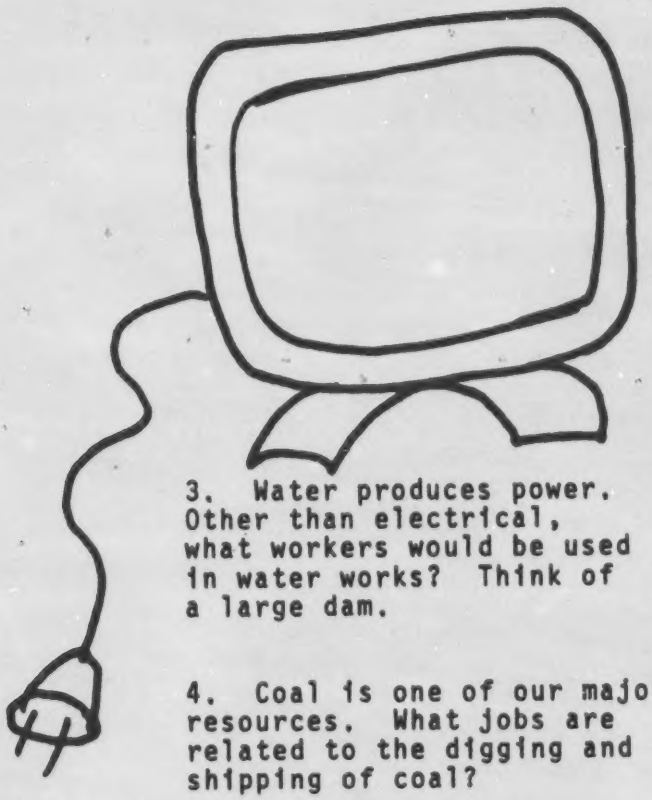
Start with the material- trace energy current through machines into the home or industry.

Research new energy sources being explored. Discuss your findings with your class.

CONCEPT: CAREER KNOWLEDGE

OBJECTIVE: The student will be aware that the field of energy offers major career opportunities and satisfying work experiences.

ACTIVITY: CAREER INTERESTS



1. List the jobs that can be done in the field of electricity.

2. List jobs that are oil and gas related.

What big oil companies have offices near your school?

3. Water produces power. Other than electrical, what workers would be used in water works? Think of a large dam.

4. Coal is one of our major resources. What jobs are related to the digging and shipping of coal?

CONCEPT: CAREER APPLICATION

OBJECTIVE: The student will identify energy related jobs in society today.

ACTIVITY: GROUP WORK

DIVIDE THE CLASS INTO FOUR GROUPS. HAVE EACH GROUP LIST RELATED JOBS IN THE FOLLOWING AREAS:

1. GAS INDUSTRY

2. WATER POWER - ELECTRCITY

3. COAL INDUSTRY

4. SOLAR AND NUCLEAR ENERGY

CONCEPT: CAREER VALUES

OBJECTIVE: The student will discuss the types of tasks performed in the energy field.

ACTIVITY: RESEARCH

Give the list of occupations relating to science to the class. Let each student select a job she/he would like to do. After selecting a job the student will:

1. Write a paper on the job. (with illustrations)
2. Give an oral report to the class.
3. Interview a person who has this job.
4. Describe 5 tasks these workers would perform.

OCCUPATIONS:

1. T.V. Repairman
2. Maintenance for T.V. Tower
3. Radio astronomy
4. Xerox duplicator
5. Radio repairman
6. Electrical engineer
7. Small Appliances repairman
8. Large appliances repairman
9. Air condition salesperson
10. Gas burner repairman
11. Biology teacher
12. Industrial Engineer
13. Pipeline layer
14. Executive in an oil company
15. Operator of heavy machinery
16. Mechanical Engineer
17. Coal miner
18. Electric line repairman
19. Meter reader
20. Other_____

CONCEPT: RECREATIONAL KNOWLEDGE

OBJECTIVE: The student will be aware that the supply of world energy affects the way we use leisure time.

ACTIVITY: DECISION MAKING

HYPOTHETICAL SITUATION # 1

Gasoline is rationed. There is no gas to be used for any travel except to work. You are to spend leisure time in those places where you can walk. List ten (10) enjoyable activities that are available to you.

HYPOTHETICAL SITUATION # 2

You have a recreational vehicle that is fully equipped. You have time and gasoline for a three week trip. You also have access to camping grounds with electrical and gas hook-ups.

1. List places and distances traveled and activities involved. Use maps to make wise decisions.

CONCEPT: RECREATIONAL APPLICATION

OBJECTIVE: The student will list favorite recreational activities and determine the type of energy used in each.

ACTIVITY: EXPLORATION

1. Have students bring electrically powered appliances and toys which function solely in recreation or entertainment to school. Determine if battery operated toys should be included.

2. Research these questions as it relates to each toy.

   a. How long has this item been on the market?

   b. Was it marketed to fill a need, or did it appearance on the market, along with advertising, create its own need?

   c. If it indeed fills a need, can we think of alternative diversions which require no energy consumption? These may already exist, or could be created by students.

   d. Explore what the children in colonial days used for recreation. Did they have the same needs for recreation as we do today.

3. By observing at local department and stationery stores, students may make a list of games, puzzles and diversions which are commercially produced versions of activities that can be done with no materials, or common household items. Have students discuss why sale of these items is successful. Older students may be able to relate this to generic American principles that underlie attitudes regarding the general lifestyles-affluence, materialism, status, prestige, etc.

CONCEPT: RECREATIONAL VALUES

OBJECTIVE: The student will discuss how decisions, lifestyles, and leisure time affect energy efficiency.

ACTIVITY: PROBLEM SOLVING

You have only $1.00 to spend on a full week end. Plan to have 4 hours of recreation on Saturday and 5 hours of recreation on Sunday. List activities in which you would engage. Stay within your $1.00 limit.

Did you use any energy resources? List the energy resources used.

CONCEPT: SOCIO-LEGAL KNOWLEDGE

OBJECTIVE: The student will be aware that the supply of and use of energy is directly related to the world's economic and polictical well-being.

ACTIVITY: DEBATE

We have learned that world economics and politics are related to the use and supply of energy. When the United States was having political problems with Arabia the the use of gasoline was curtailed in this country and prices rose. Arabian Countries again began shipping oil to the United States after diplomatic relations improved. During times of war fuel is very much in demand. The heavy drain on supplies cause people to ration energy uses. When a country is in an economic depression or recession the use of energy is reduced.

Technicans in the field of science, are working as rapidly as possible to find other sources of fuel for the future.

A nation's economic well being is tied directly to its technological level of development, reflecting a comparable energy usage figure. "The less affluent people of the world aspire to the same economic and social levels currently enjoyed by most Western Countries. However, there are not enough natural resources to support everyone in the world at our level of influence".

The Western Countries have oil and gas but Iran, Iraq, Saudi Arabia,and Kuwait produce 20% of the world's petroleum. The Mid East accounts for 40% of the world's petroleum.

Census figures show that, 200 million people live in the United States. The per capita energy consumption shows that Americans consume 90 times as much energy as the average citizen of India

How will scientists find new sources of energy to assure economic well being and be respected politically by other nations? Some solutions could be those found on the following page.

1. Petroleum companies will turn to remote areas i.e. off shore drilling.

2. Energy facilities will be constructed near consuming market .

3. Geologists will try to uncover the hard-to-find raw materials, such as uranium, that will produce nuclear fuels.

4. Solar energy will be developed. In this area converters need to be much cheaper in order to turn photovoltaic sunlight into electricity.

5. Automobiles will be operated by electricity.

6. Scientists will approach fussion with the magnetic confinement method.

7. Scientists in battery research are finding sodium-sulfur batteries are capable of producing 10 times as much energy as our present lead-acid battery.

8. Scientists are experimenting with the manufacturing of synthetic oil and gas from coal.

In order to study possible ways of meeting the problem of energy shortages form teams to debate which of the above is most feasible in future energy sources. Consider cost, availability of materials, and time.

Research the above topics. Assign oral and written reports in preparation for the debate.

CONCEPT: SOCIO-LEGAL APPLICATION

OBJECTIVE: The students will maintain files of newspaper clippings and magazine articles related to the supply and use of energy to determine the impact on their community, state, and nation and on the world.

ACTIVITY: USING THE NEWSPAPER

Newspaper and magazine articles on energy can be found almost everyday. Most newspaper articles are factual and unbiased. Some magazine articles are also informative and not "slanted". Some articles in magazines will have biased "slants". Overall we learn much from magazines and newspapers about energy and its impact on all cities, nations and countries.

Files of newspaper and magazine articles can be used for:

1. Oral reports
2. Writing summaries
3. Vocations involved
4. To point out the role science plays in assuring energy sources in the future
5. Look for trends in world politics to determine how nations with large energy resources have influence.

Read and discuss the article on the following page taken from the Houston Chronicle on October 20, 1978.

Consider what the objections would be to:

1. Nuclear Power
2. Solar energy
3. Biomass energy

PAGE 55 REMOVED DUE TO COPYRIGHT RESTRICTIONS

CONCEPT: SOCIO-LEGAL VALUES

OBJECTIVE: Students will compare energy uses in their homes and communities.

ACTIVITY: COMPARISONS

Ask the students to bring an electric bill, a water bill and a gas bill from home.

Compute a year's total of each resource.

Bills will vary. Let the students tell how many electrical facilities are in their homes. List the number of electrical appliances large and small.

How many lights are in the house? What watt are they?

Research which type of light bulb gives the most light using less energy.

TABLE OF CONTENTS

ENERGY CONCEPT (Teaching Skill)	
OBJECTIVE:	page #

CONSUMER KNOWLEDGE (Discussions)

The student will understand that energy conservation will affect his/her behavior as a consumer.....1

CONSUMER APPLICATION (Comparisons)

The student will describe efficient cars.....3

CONSUMER VALUES (Conclusions)

The student will list advantages and disadvantages of an efficient car.....4

INDIVIDUAL WELL-BEING KNOWLEDGE (Conclusions)

The student will be aware of interdependence of energy and personal comfort.....5

INDIVIDUAL WELL-BEING APPLICATION (Experimenting)

The student will determine how individual well-being and group well-being are improved by energy conservation.....6

INDIVIDUAL WELL-BEING VALUES (Comparing and Contrasting)

The student will compare effects of energy efficiency vs. inefficiency on personal comfort and well-being....10

CAREER KNOWLEDGE (Predictions)

The student will understand that changing patterns of energy use affect career opportunities.....11

CAREER APPLICATION (Discussions)

The student will determine changes which energy conservation practices will have on job opportunities.....12

CAREER VALUES (Recognizing Differences)

The student will list the changes which have occurred in his parents' careers because of changing energy availability.....13

RECREATIONAL KNOWLEDGE (Charting Activities)

The student will determine how the availability of energy and conservation will affect recreaional activities.....14

RECREATIONAL APPLICATION (Predictions)

The student will list and compare energy efficient and inefficient recreational activities.....15

RECREATIONAL VALUES (Ratings)

The student will be aware of changes in recreational lifestyles because of energy conservation.....16

SOCIO-LEGAL KNOWLEDGE (Experimenting)

The student will understand that improved energy conservation practices will cause major changes in individual lifestyles and society.....17

SOCIO-LEGAL APPLICATION (Determining Problem Areas)

The student will be aware of two major changes in laws and customs which have taken place in the areas of transportation, housing and recreation as a result of energy shortages.....19

SOCIO-LEGAL VALUES (Comparisons)

The student will compare present and projected laws in the area of transportation and housing as a result of energy conservation practices.....20

CONCEPT: CONSUMER KNOWLEDGE

OBJECTIVE: The student will understand that energy conservation will affect his or her behavior as a consumer.

ACTIVITY: DISCUSSIONS

For years the concern for proper natural resource use was confined to a very small group of serious-minded conservationists. A majority of the American people felt that America's energy resources were limited. There was little apparent need for the average citizen to be concerned about the wise use of energy resources.

Although people were warned of the critical need to practice conservation, and to consider the potential limit of resources, they were often thought of as people who wanted to go back to a cave existence. In addition, these individuals were often considered prophets of doom in their predictions. Consequently, the throw-away society flourished almost unchallenged.

In the early 70's the conservation ethic took a new form. The need to avoid the waste of resources, and to consider environmental degradation was supported by a larger, more vocal group of citizens.

Now, the energy problem is on the minds of practically every citizen. However, there are still those who refuse to believe that the crisis is real and continue to find excuses for justifying continued waste.

Hopefully, we will finally begin to take to heart what the conservationists have been telling us for years: The world is finite, our resources are finite, and if we wish to maintain a comfortable lifestyle in a technological society, we must adopt the conservation ethic. The quality of our future existence depends on it.

DISCUSS EACH OF THE FOLLOWING:

1. Is there an energy problem?

2. How have energy problems come about?

3. How can energy problems affect you as a student?

4. Will the energy problem become more critical in the future if consumers do not become aware of their responsibilities in the energy conservation area?

CONCEPT: CONSUMER APPLICATION

OBJECTIVE: The student will describe energy efficient cars.

ACTIVITY: MAKING COMPARISONS

Interview 5 members of the faculty with full size cars and 5 members of the faculty with small cars. Ask each group these questions related to energy:

1) What is the weight of your automobile?

2) What is the engine size?

3) What type of fuel does your car use?

4) What is your estimated mileage per day?

5) What is your estimated MPG?

Students will write a paragraph comparing gasoline consumption and mileage between large and small cars.

CONCEPT: CONSUMER VALUES

OBJECTIVE: The student will list advantages and disadvantages of an efficient car.

ACTIVITY: DRAWING CONCLUSIONS

Interview a faculty member with a large family (four or more) and a faculty member with a small family (less than four). Use data from your interview and from the activity on consumer applications to complete the following chart:

	LARGE CAR	SMALL CAR
Monthly gasoline bill		
Repairs over a six month period		
Space available for trips		
Driving enjoyment and comfort		

What conclusions can you make about the following:

1. Which automobile has more advantages?
2. Which automobile has more disadvantages?
3. Is it possible for large families to make use of a small car or do they need a large car?

CONCEPT: INDIVIDUAL WELL-BEING KNOWLEDGE

OBJECTIVE: The student will be aware of interdependency of energy use and personal comfort.

ACTIVITY: DRAWING CONCLUSIONS

Students will make a list of energy using appliances in their homes. Determine those used for recreation and personal comfort. Which ones are powered by electricity? By gas?

Student will obtain family electric and gas bills for one month. Which energy using appliances were in operation during that month? Which energy using appliances were least expensive to operate? Which were most expensive?

What conclusions can you draw about appliances necessary for living?

CONCEPT: INDIVIDUAL WELL-BEING APPLICATION

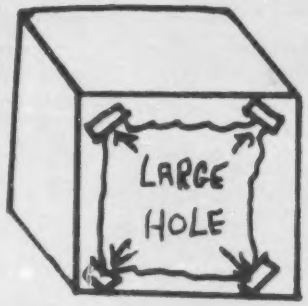
OBJECTIVE: The student will determine how individual well-being and group well-being are improved by energy conservation.

ACTIVITY: EXPERIMENTING

HOW MUCH HOTTER DOES A HOUSE GET WHEN THE WINDOWS FACE SOUTH INSTEAD OF NORTH?

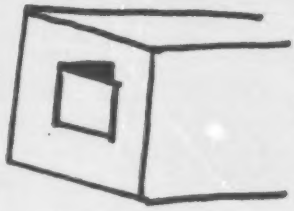
Materials:

2 cardboard boxes the same size
white paint or paper
2 thermometers
plastic wrap
masking tape



Cut a large hole in one side of one box and cover it with plastic wrap. Tape tightly all the way around.

Paint both boxes white, or cover them both with white paper.



(Tip: cut a little door in the second box so you can read the thermometer)

Place a thermometer in each box and put them in the sun.

Window facing sun

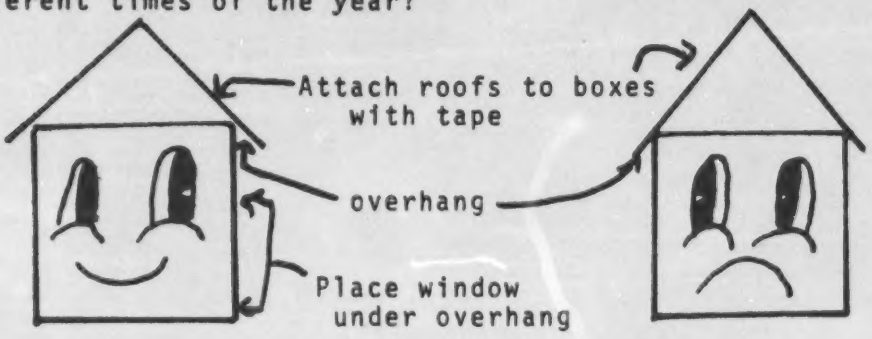
Box without window

Record temperatures after 10, 20 and 30 minutes. What do you find?

OTHER IDEAS TO EXPLORE:

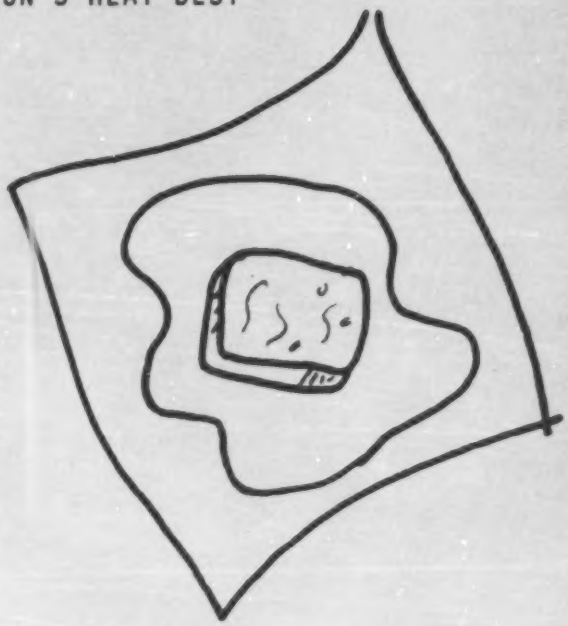
Try the same experment at different times during the day. Does this make any difference?

How would the overhang affect this experiment at different times of the year?



Try cardboard overhangs of different size to see if it makes a difference

WHAT COLORS ABSORB THE SUN'S HEAT BEST



Materials:

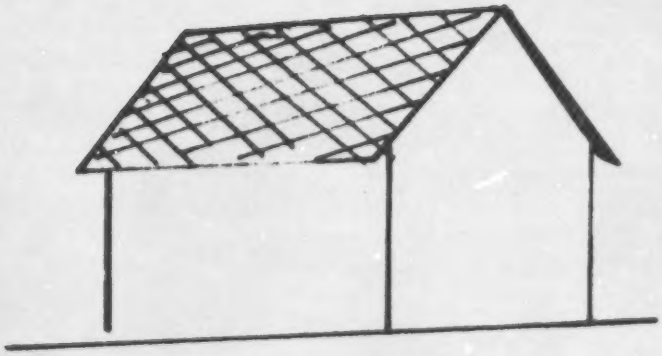
white, black, green, red and blue construction paper all the same size

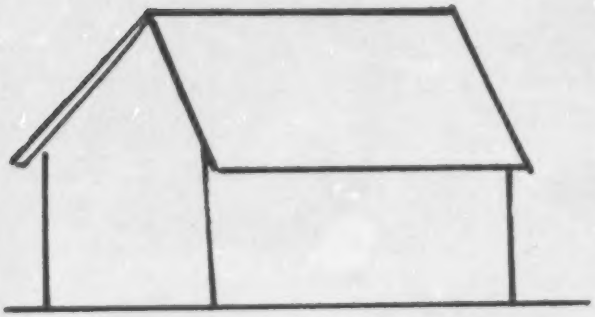
timer

uniformly-sized ice cubes

Place an ice cube on top of each sheet of construction paper. Which melts first?

Would a house with a white roof be cooler than a house with a dark rook?





OTHER IDEAS TO EXPLORE

Would a house with a dark roof be more expensive to air-condition?

Would you get the same results if the paper were on top of the ice cube?

Does it work faster with the paper on the top or on the bottom?

CONCEPT: INDIVIDUAL WELL-BEING VALUES

OBJECTIVE: The student will compare effects of energy efficiency vs. inefficiency on personal comfort and well-being.

ACTIVITY: COMPARING AND CONTRASTING

Compare and contrast the advantages and disadvantages, energy-wise, of the following pairs of alternatives:

1) Dishwasher vs. doing dishes in sink

2) Electric razor vs. blade razor

3) Power mower vs. hand mower

4) Gas stove vs. electric stove

5) Shower vs. bath

CONCEPT: CAREER KNOWLEDGE

OBJECTIVE: The student will understand that changing patterns of energy use affect career opportunities.

ACTIVITY: MAKING PREDICTIONS

The student will write a paragraph on the type of jobs he thinks were most prevalent when wood fuel was a major source of our nation's energy.

Sources of reference could be Personnel Departments of major oil companies in the immediate area. Then consider the same problem with coal, oil, gas and electricity.

Suppose we were able to use the sun's energy directly. What new types of jobs would be eliminated or reduced? What new jobs would be available?

CONCEPT: CAREER APPLICATION

OBJECTIVE: The student will determine changes which energy conservation practices will have on job opportunities .

ACTIVITY: DISCUSSIONS

Assume one of the following is to be constructed in your community:

1) A coal-fired electric power plant

2) An oil-fired electric power plant

3) A gas-fired electric power plant

4) A nuclear-fired electric power plant

DISCUSS:

What jobs would be eliminated by each plant's construction?

What jobs would be created by each plant's construction?

What would happen in your community if one of these plants were constructed?

As a source of reference use major oil companies in your area.

CONCEPT: CAREER VALUES

OBJECTIVE: The student will list the changes which have occurred in his parent's career because of changing energy availability.

ACTIVITY: RECOGNIZING DIFFERENCES

Students will interview their mother or father to determine how parents' careers have been affected in the last 20 years as a result of fluctuating energy availability. Based on the interview the student should write a paragraph comparing differences and changes between the parents' career then and today as they have changed because of energy availability.

CONCEPT: RECREATION KNOWLEDGE

OBJECTIVE: The student will determine how the availability of energy and conservation will affect recreational activities.

ACTIVITY: CHARTING ACTIVITIES

With the price of gasoline expected to go higher and higher in future months and years automobile travel will perhaps be reduced considerably. Student should fill in the chart for one week for all automobile travel used for recreational activities.

MONDAY

TUESDAY

WEDNESDAY

THURSDAY

FRIDAY

SATURDAY

SUNDAY

If prices of gasoline increase three times what it is today how would you expect that to affect your automobile travel record of your chart?

Fill out another chart to illustrate travel that might be eliminated.

How will this affect your recreational activities?

CONCEPT: RECREATIONAL APPLICATION

OBJECTIVE: The student will list and compare energy efficient and inefficient recreational activities.

ACTIVITY: MAKING PREDICTIONS

The student will select an art form such as painting and determine the types of energy used to produce it (include all raw materials).

Compare the energy used in that activity with that used in an automobile sports car race.

What types of energy are involved in each activity? Which activities might be done less frequently if energy production is reduced?

CONCEPT: RECREATIONAL VALUES

OBJECTIVE: The student will be aware of changes in recreational lifestyles because of energy conservation.

ACTIVITY: RATINGS

Below is a list of items that might be included in a recreational category. How has each one of these changed in the last three years because of energy conservation?

Rate on a scale of 1 to 5 using "X" for 3 years ago and a "O" for the present.

Amusement parks	1	2	3	4	5
Record players	1	2	3	4	5
Go-carts	1	2	3	4	5
Electric trains	1	2	3	4	5
Movies	1	2	3	4	5
Motor bikes	1	2	3	4	5
Little league baseball	1	2	3	4	5
Electric games	1	2	3	4	5

How would you expect these to change in the future if energy becomes less available?

CONCEPT: SOCIO-LEGAL KNOWLEDGE

OBJECTIVE: The student will understand that improved energy conservation practices will cause major changes in individual lifestyles and society.

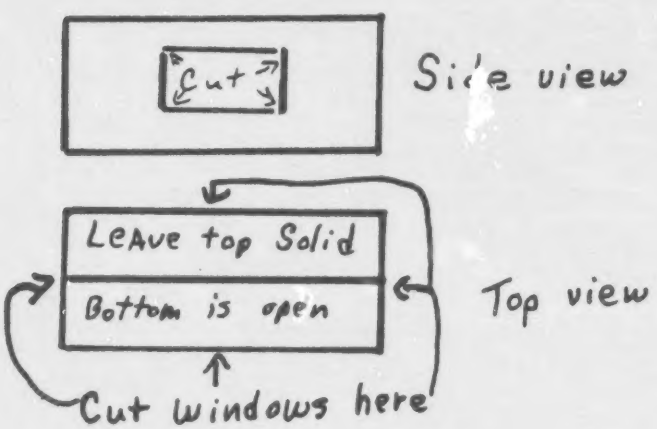
ACTIVITY: EXPERIMENTING

What's the best INSULATOR

Materials:

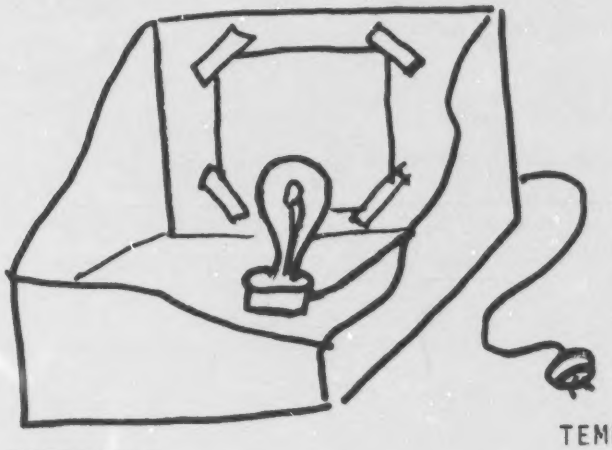
100 Watt bulb in ceramic socket - see drawing
A variety of insulating and non-insulating materials such as wood, aluminum foil, fiberglass (3" or 4") glass, metal, newspaper, heavy cloth, etc.
4 thermometers
masking tape

Set up the box like this:



Tape 4 insulating materials over the windows on the inside of the box. Then, tape a thermometer to the outside of each insulating material and record before and after temperatures.

Turn the lamp on for five minutes. Record the rise in temperature for each material. How much better is the best insulator compared to the worst? Record your results on the chart below.



Why is insulation now required in new homes?

Why hasn't this always been so?

MATERIALS	TEMPERATURE	
	BEFORE	AFTER
wood		
Aluminum foil		
Fiberglass		
Glass		
Metal		
Newspaper		
Cloth		

CONCEPT: SOCIO-LEGAL APPLICATION

OBJECTIVE: The student will be aware of two major changes in law or social customs which have taken place in the areas of transportation, housing, and recreation as a result of energy shortages.

ACTIVITY: DETERMINING PROBLEM AREAS

The student will interview ten faculty members to determine the number of people that travel to work separately, by buses, or in carpools. How do you think these numbers will change in the future if an energy shortage develops?

The student will measure the total areas of windows and walls in his classroom.

How much glass is there on the window side of your classroom? How much wall?

Feel the glass and the wall. Which carries heat better? Would you save energy if you had fewer windows?

How is your school situated with regard to the sun? How might construction of new schools change in the future with an energy shortage?

Contact local offices of Sports Car Club of America. Determine how many automobile rally events are scheduled for 1978. Compare that number with the number of events scheduled in 1975. Is the number greater, less, or about the same?

How is this likely to change in the future with an energy shortage?

CONCEPT: SOCIO-LEGAL VALUES

OBJECTIVE: The student will compare the present and projected laws in the areas of transportation and housing as a result of energy conservation practices.

ACTIVITY: COMPARISONS

The student will read September 1976, 1977 and 1978 Motor Trend Magazine:

1) List changes in pollution control devices, standard engine size, and automobile size for the new cars during the three year period.

2) How do you think these categories might change in the future with a continuing shortage of energy?

The student will contact Houston Lighting and Power Company to determine what constitutes an "Energy Checked" new home. What additional items might be part of the construction of a new home in the future because of an energy shortage?

TABLE OF CONTENTS

ENERGY CONCEPT (Teaching Skill)	
OBJECTIVE:	page #

CONSUMER KNOWLEDGE (Observation)

The student will be aware that consumer decisions are usually directed by one's particular environment or culture.....1

CONSUMER APPLICATION (Developing Concepts)

The student will identify the useability span of four types of beverage containers.....3

CONSUMER VALUES (Outline)

The student will discuss cultural differences in energy patterns.....6

INDIVIDUAL WELL-BEING KNOWLEDGE (Reading For Information)

The student will be aware that a sufficient supply of energy depends essentially on lifestyles and the wise use of natural resources.....9

INDIVIDUAL WELL-BEING (Classification)

The student will be aware of wasteful uses of energy at home and in the community and will be able to determine measures which increase the sufficient supply of energy.....11

INDIVIDUAL WELL-BEING VALUES (Chart Skills)

The student will discuss how the use of energy affects dividual well-being and the fate of generations to come.....14

CAREER KNOWLEDGE (Using References)

The student will be aware that the field of energy offers career opportunities and satisfying work experiences.....16

CAREER APPLICATION (Map Skills)

The student will identify energy related jobs in society today.....18

CAREER VALUES (Role Playing)

The student will discuss the types of tasks performed in jobs in the energy related fields.....21

RECREATIONAL KNOWLEDGE (Research)

The student will be aware that the supply of world energy affects the way we use leisure time.....22

RECREATIONAL APPLICATION (Charts)

The student will list favorite recreational activities and determine the type of energy used.....23

RECREATIONAL VALUES (Pantomiming)

The student will discuss how decisions, lifestyles and leisure time affect energy efficiency.....24

SOCIO-LEGAL KNOWLEDGE (Multiple Choice)

The student will be aware that the supply and use of energy is directly related to the world's economic and political well-being.....26

SOCIO-LEGAL APPLICATION (Charts)

The student will maintain files of newspaper clippings and magazine articles related to the supply and use of energy to determine their impact on the community, state and world.....28

SOCIO-LEGAL VALUES (Using the Newspaper)

The student will compare energy use in their homes and community.....29

CONCEPT: CONSUMER KNOWLEDGE

OBJECTIVE: The student will be aware that consumer decisions are usually directed by one's particular environment or culture.

ACTIVITY: OBSERVATION

In light of present and future energy needs, it is important to examine our attitudes and our understanding of the role and importance played by energy in our daily lives. Because most forms of energy are not visible, it is easy to take them for granted.

Using the chart on the next page, make weekly observations and record the actions of people as they relate to energy conservation.

NAME:	ACTION
1.	
2.	
3.	
4.	
5.	

Following the observation, conduct a personal interview of the people observed to obtain a record of what they say, do, and believe.

PERSONAL INTERVIEW			
NAME:	What they say-	What they do-	What they believe-

Compare the data of the observations and personal interview about energy conservation. Make a statement which shows that consumer decisions are usually directed by one's environment or culture.

CONCEPT: CONSUMER APPLICATION

OBJECTIVE: The student will identify the useability span of four types of beverage containers.

ACTIVITY: DEVELOPING CONCEPTS

The increased production of goods and services resulting in the increased use of natural resources has caused environmental problems. When worn out goods and equipment are disposed of, there are litter and solid waste problems which demand the use of energy resources.

One way to reduce this drain of our natural resources is recycling. Recycling means reusing our trash instead of getting rid of it.

More than 60% of all copper scrapped annually is retrieved.

Nearly one-half of all aluminum produced annually is salvaged for reuse. One fourth of all steel produced in the United States each year and about one-fifth of all paper products are reclaimed.

Used aluminum beverage containers are melted to make new metal for new cans.

Glass bottles are crushed into tiny glass bits and melted. This is used to make new glass.

Paper is recycled by de-inking, cooking in water and acids, and drying into paper or cardboard.

Tin containers are shredded and then melted.

Plastic milk bottles are free of health hazards and may be used as a fuel with high heat value.

When communities are faced with these disposal problems resysling becomes an appealing solution. But recycling has its problems too.

According to the Dayton Museum of Natural History, recycling has fallen short of overcoming two critical problems: (1) sorting and (2) the high cost of producing new products from recycled materials.

The economics of recycling still favor the use of raw materials. Recycled glass, for example, costs $ 23.77 per ton to produce, while original glass is $18.43 per ton. Recycled pulp costs $20 to $30 more per ton than virgin pulp. The same cost ratios apply to other materials as well.

The Dayton Museum of Natural History committee reported that sorting each piece of trash into its reusable elements is a king-size problem. Bottles must be sorted for quality and color. Cans present another problem: a steel body, a seam of tin and lead, an interior coating of lacquer, zinc, or tin depending on a can's contents. In a smelter all these materials melt and contaminate each other.

With some recycled material, quality becomes a problem. Recycled copper is as good as new, but the quality of recycled paper drops a step. Recycling causes paper fibers to shrink. Therefore , recycled paper is weaker than paper made from virgin fibers.

USE THE ABOVE READING TO ANSWER THE FOLLOWING QUESTIONS:

1. Why do litter and solid waste problems demand the use of energy resources?

2. Decide to start a small recycling business in beverage containers. List four types of beverage containers in the order which you think you would get the most capital and explain why you made each choice.

1. _____

2. _____

3. _____

4. _____

_____

_____

_____

_____

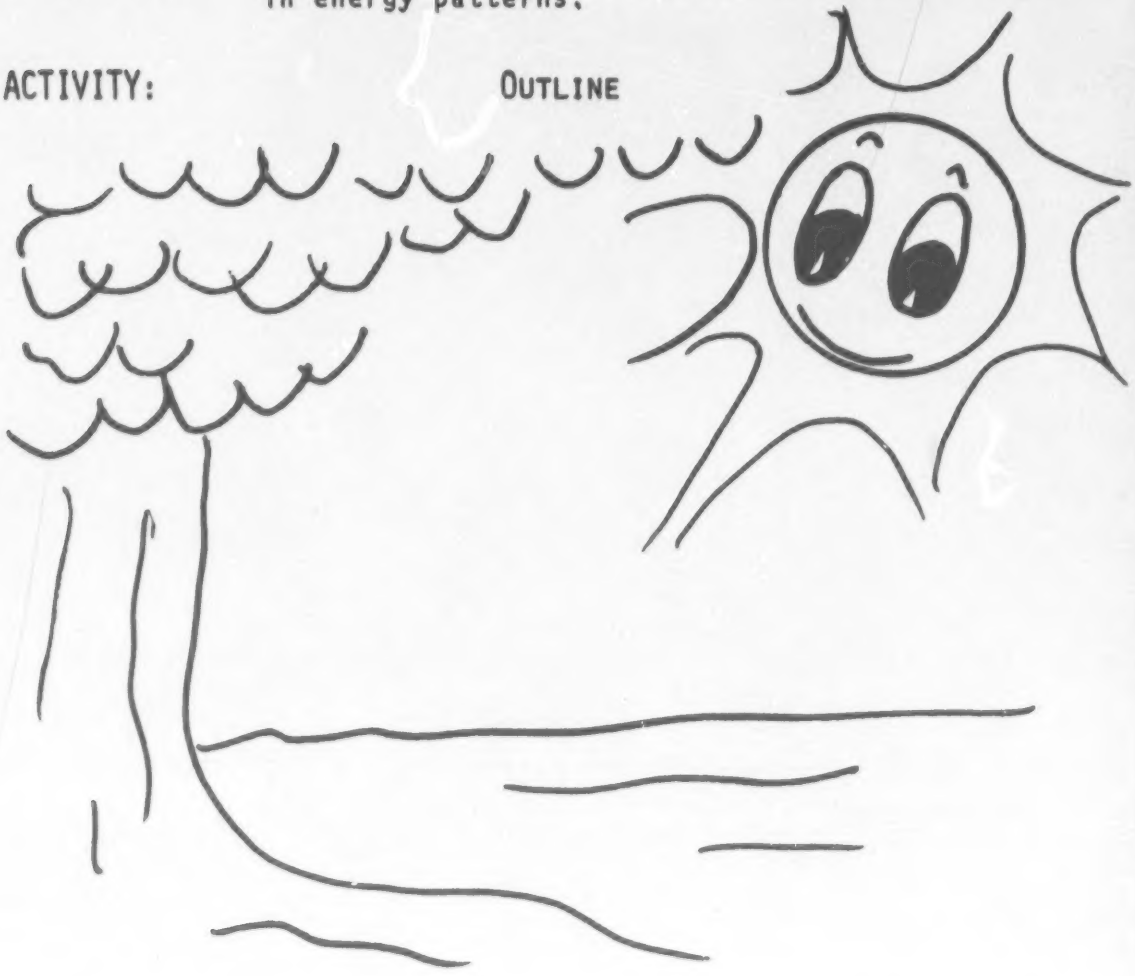
_____

_____

CONCEPT: CONSUMER VALUES

OBJECTIVE: The student will discuss cultural differences in energy patterns.

ACTIVITY: OUTLINE



Very little energy was used in early times. The rays of the sun brought heat energy to warm the bodies of early human beings. Sunlight also caused all living things on the earth to grow and to store energy. When people used these living things for food, stored energy was released in their bodies as heat energy and as muscular energy with which they could work.

The discovery of the energy of the wind opened up a new and exciting supply of energy. The first use of wind energy was probably the sail. By hoisting a crude sail of animal skins, people found that they could catch the energy of the wind to make boats travel faster and farther than was possible with oars and paddles.

Later windmills were built to grind corn, to pump water and to turn machinery. Running water added a more reliable source of energy to human beings' growing resources. These energies were free and readily replaced by the energy of the sun.

Today we use energy for convenience and comfort in our homes, stores and public places. We also use energy for production of goods in industry, for transportation of people and goods. We use energy in our recreation. Ball games are electrically lighted when held at night or indoors. Electric lifts carry skiers up mountains. Most boaters now use outboard motors instead of oars; and many toys are now electrically powered.

HOW TO WRITE AN OUTLINE:

An outline puts ideas in order. It is made up of main topics and subtopics.

A main topic is a general idea or subject. It must have two or more subtopics.

The subtopic is a smaller part of the main topic.

USING THE STORY YOU HAVE JUST READ COMPLETE THE OUTLINE ON THE NEXT PAGE AND USE IT AS A GUIDE IN DISCUSSING CULTURAL DIFFERENCES IN ENERGY USE PATTERNS YESTERDAY AND TODAY:

O U T L I N E

I. Natural energy helps man

   a. Sunlight

   b. Food

II. Early uses of energy

   a. The sail

   b. _____

III. _____

   a. _____

   b. _____

CONCEPT: INDIVIDUAL WELL-BEING KNOWLEDGE

OBJECTIVE: The student will be aware that a sufficient supply of energy depends essentially on lifestyles and the wise use of natural resources.

ACTIVITY: READING FOR INFORMATION

READ THE ARTICLE TWICE. FIRST, READ IT TO GET THE BASIC CONCEPT, THEN READ THE ARTICLE FOR DETAILS. FOLLOW THE DIRECTIONS FOUND BELOW THE ARTICLE TO COMPLETE THE ACTIVITY.

Modern man lives a more comfortable and interesting life because he has developed and discovered so many natural resources. But he must learn to use them wisely. If natural resources are wasted, future generations will suffer.

Sunshine provides warmth and other kinds of energy needed to make plants and animals grow normally healthy Without sunshine, green plants could not manufacture the foods and vitamins on which life depends.

Air provides the oxygen which is necessary to plant and animal life and carbon dioxide which green plants use in making sugar and starch.

Water is another natural resource and is necessary for all plants and animals, but more as a vehicle and a raw material than as a food.

Soil is the home of most plant life and provides most of our food.

Forests provide lumber, trupentine, latex and other substances. Hundreds of useful products, such as rubber and wooden objects of all kinds are made from trees.

Minerals that are treasures of the earth include - gold, iron, silver, coal and uranium. Products which add to our comfort include dishes, clocks, stoves and nails made from minerals.

Wildlife includes all wild animals and wild plants. Many animals are hunted for food and furs. Some wild plants, such as rasberries, also provide food.

DIRECTIONS: Place the letter"t" for the word "true" or the letter "f" for the word "false" in the blank before each statement. If the sentence is false rewrite the sentence correctly on the lines provided. If it is true, add another true sentence about the same subject.

EXAMPLES:

T 1. Modern man lives a comfortable and interesting life.

Modern man discovered many natural resources.

F 2. Wildlife includes all wild animals and soil.

Wildlife includes all wild animals and wild plants.

COMPLETE THE FOLLOWING AS ABOVE:

_____ 1. Natural resources should be used wisely.

_____ 2. Air provides turpentine for plants and animals.

_____ 3. Soil is not the home of most plant life.

_____ 4. Some minerals are gold, iron and silver.

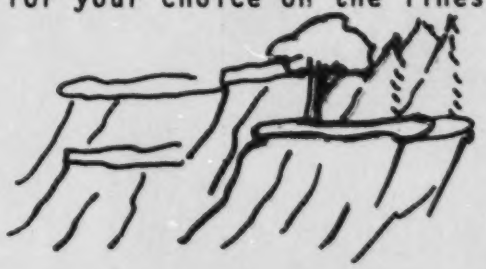
_____ 5. If natural resources are wasted, future generations will suffer.

CONCEPT: INDIVIDUAL WELL-BEING APPLICATION

OBJECTIVE: The student will be aware of wasteful uses of energy at home and in the community and will be able to determine measures which increase the sufficient supply of energy.

ACTIVITY: CLASSIFICATION

The pictures below show four ways of using energy. Beside each picture, (✓) whether a wise or unwise use is shown. Then, check each reason which tells why you answered as you did. Write other reasons for your choice on the lines provided.



_____wise

_____unwise

_____Because there is much good topsoil on the earth

_____Because grass and trees have not been planted to help hold the soil.

_____Because new land will be made at the mouth of some river.

_____Because there is only a thin layer of topsoil on the earth.

_____

_____

_____

_____

_____wise

_____unwise

_____Because it takes many years to grow trees so large.

_____Because trees grow very rapidly.

_____Because people need good houses.

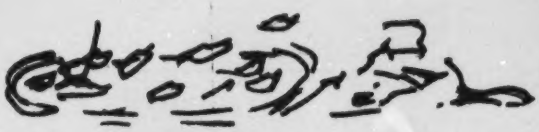
_____Because trees provide beauty, shade, homes for birds, and woo d.

_____

_____

_____

_____



_____wise

_____unwise

_____Because leaves should be burned.

_____Because grass will not grow if leaves are left on the ground.

_____Because leaves decay and form soil.

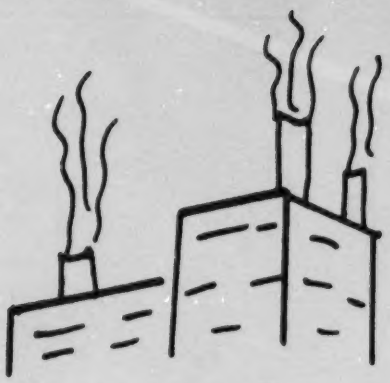
_____Because leaves should be left on the ground.

_____

_____

_____

_____



_____wise

_____unwise

_____Because people have to breathe the air.

_____Because something is being wasted in the smoke.

_____Because the smoke will help to shade the earth from the rays of the sun.

_____Because it will rain harder if there is some smoke in the air.

_____

_____

_____

_____

Add to the list below as many ideas you can think of that will increase the sufficient supply of energy.

1. In winter, set the thermostats at 68 degrees during the daytime, 65 degrees at night.
2. Use less water for showers and baths.
3. Wear more clothing in cold weather.
4. Don't leave water running while brushing your teeth.
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

CONCEPT: INDIVIDUAL WELL-BEING VALUES

OBJECTIVE: The student will discuss how the use of energy affects individual well-being and the fate of generations to come.

ACTIVITY: CHART SKILLS

Whether individuals squander energy resources through ignorance or inefficiency, the results are the same - costly. The use of energy in heating and cooling the homes is costing more money than ever before. Increased efficiency of energy use through conserving techniques can lower the general public's energy costs and enable future generations of Americans to enjoy the energy benefits our society enjoys today.

Below is a list of energy conservation ideas taken from recently published sources pertaining to the current energy shortage.

Use the chart on the next page and the list to indicate which of the following people should assume responsibility for accomplishing the tasks. Group A = Children, Group B = The school and Group C = all people.

1. Schedule all school meetings during daylight hours.
2. Insulate all heating, piping and ducts exposed.
3. Eliminate the use of air conditioning until room temperature is above 78 degrees.
4. Maintain halls, gyms, and auditoriums at a lower temperature (65 degrees).
5. Avoid blocking heating vents with draperies or furniture.
6. Ride your bike.
7. Use public transportation.
8. Keep lights off when the room is not in use.
9. Wash only full loads in the dishwasher and washing machine.
10. Hang clothes outside to dry whenever possible.
11. Keep television,radio and stereo off when not in use.
12. Turn off lights whenever natural lighting is suitable.
13. Replace broken windows.
14. Reduce speed when driving.
15. Repair leaking fixtures.
16. Regularly replace air conditioner and heater filters.

17. Use cold or warm water, rather than hot water, whenever possible.
18. Keep doors to corridors or hall closed (except when the thermostat is in the hall).

COMPLETE THE CHART BY PLACING THE NUMBER OF EACH ITEM IN THE CORRECT COLUMN.

Group A Children	Group B Schools	Group C All People

Students will use the chart above to discuss how the use of energy affects the well- being of an individual.

Using the same chart, the students will also discuss how the use of energy today will affect the fate of generations to come.

CONCEPT: CAREER KNOWLEDGE

OBJECTIVE: The student will be aware that the field of energy offers major career opportunities and satisfying work experiences.

ACTIVITY: USING REFERENCES

A reference is a book referred to for information on a specific or general subject. Usually the subject headings are in alphabetical order. Dictionaries, Almanacs, and Encyclapedias are reference books.

In the United States, the petroleum industry ranks as one of the giants of American business. About 1½ million people earn their living from petroleum related occupations. Its customers include almost everyone in the United States and millions of persons in other countries. Petroleum companies have an investment of over 80 billion dollars in plants, property and machinery. About 40,000 companies, not including service stations, make up the petroleum industry in the United States.

Because of the major career opportunities in the field of petroleum and your concern about the future of energy, use the encyclopedia to find information on the occupations related to the petroleum industry.

Geologist
Petroleum Engineer
Environmental Engineer
Chemist
Geophysicist
Salesman
Mechanic

Allow students others to work with if they elect to do so.

Students may use note cards on the following page to take notes.

NOTE CARDS

CONCEPT: CAREER APPLICATION

OBJECTIVE The student will identify energy related jobs in society today.

ACTIVITY: MAP SKILLS

Study the map showing mining and the key carefully. (Map can be found on the following page) Notice the chief regions for coal and petroleum. The eastern part of the United States has large areas of these two products. In quite a few places the coal and petroleum overlap.

Study the map showing the manufacturing regions. The largest manufacturing region is the northeastern part of our country. In this area are large coal deposits. Nearby are iron mines. There is good water transportation and large cities.

By studying these maps, you should be able to answer the following questions concerning the use of energy.

1. There are iron and steel plants in western Pennsylvania. From where do you think the factories get their iron ore?

_____

2. How would the ore be brought to these Pennsylvania factories?

_____

3. Can you give a reason why there is manufacturing along the coast in Texas?

_____

_____

4. If you were a chemist for a petroleum company in which state would you rather live? Why?

_____

_____

5. For which mineral is Texas noted?

_____

6. List five states where energy related jobs seem promising.

_____

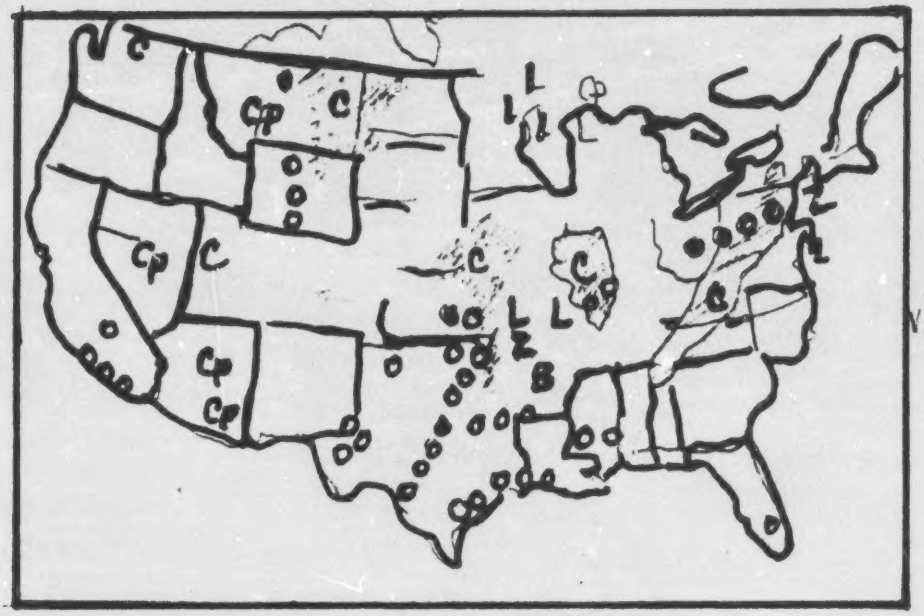
_____

_____

_____

_____

THE CHIEF LOCATIONS OF COAL, PETROLEUM AND OTHER IMPOTANT METALS



KEY

C = Coal	O = Petroleum
P = copper	B = Bauxite
I = Iron	L = Lead
Z = Zinc	

PRINCIPAL AMNUFACTURING REGIONS

CONCEPT: CAREER VALUES

OBJECTIVE: The student will discuss the types of tasks performed in jobs in the energy related fields.

ACTIVITY: ROLE PLAY

I. From your knowledge gained through research in career opportunities, choose an occupation you can picture yourself doing. Think about the types of tasks the job calls for and the working conditions.

EXAMPLE: The Sheet Metal Worker builds products from flat sheets of metal and then installs the finished product. He is responsible for the system ducts, electronic air cleaning in buildings and homes.

The Sheet Metal Worker works both inside and out. He must have the ability to climb ladders and work from scaffolds to erect sheet metal ducts. He must always be safety conscious. The metal worker can be cut by the tools he uses or by the sharp edges of the metal with which he works.

II. Make a puppet with a paper bag, sock, stick, etc.

Dress the puppet in clothes suitable for the job you have selected.

III. Dramatize the occupation either alone or with other members of your class.

IV. At the end of each story, students will make a chart showing the following:

1. Workers

2. Character building characteristics

The students will use the chart while discussing the types of tasks performed in jobs in the energy field.

CONCEPT: RECREATIONAL KNOWLEDGE

OBJECTIVE: The student will be aware that the supply of world energy affects the way we use leisure time.

ACTIVITY: RESEARCH-GENERALIZATION

Read the generalization below. Find proof to support the generalization. Tell what the proof is and identify the concept(s) and the objective(s).

GENERALIZATION:

THE SUPPLY OF WORLD ENERGY AFFECTS THE WAY WE USE LEISURE TIME.

CONCEPT: RECREATIONAL APPLICATION

OBJECTIVE: The student will list favorite recreational activities and determine the type of energy used.

ACTIVITY: CHARTS

Recreation is something which not only gives us pleasure, but also helps to renew or recreate, the mind and the body. Society in general reaches a higher level of culture when large numbers of persons have time to develop their personalities and interests to the fullest possible extent. Recreation involves many types of energy.

Add at least five of your favorite sports to the chart below and tell the type of energy used in each:

ACTIVITY:	TYPE OF ENERGY USED
1. Swimming	Human energy
2. T.V. Tennis	Electrical
3.	
4.	
5.	
6.	
7.	

CONCEPT: RECREATIONAL VALUES

OBJECTIVE: The student will discuss how decisions, lifestyles, and leisure time affect energy efficiency.

ACTIVITY: PANTOMIMING

Pantomime is a means of expression. You can act out an entire story by the movements of your body and the expressions on your face.

Here is a list of things that most people do at some time or another. Think about how you could pantomime each of these.

1. Dancing
2. Jumping
3. Bathing

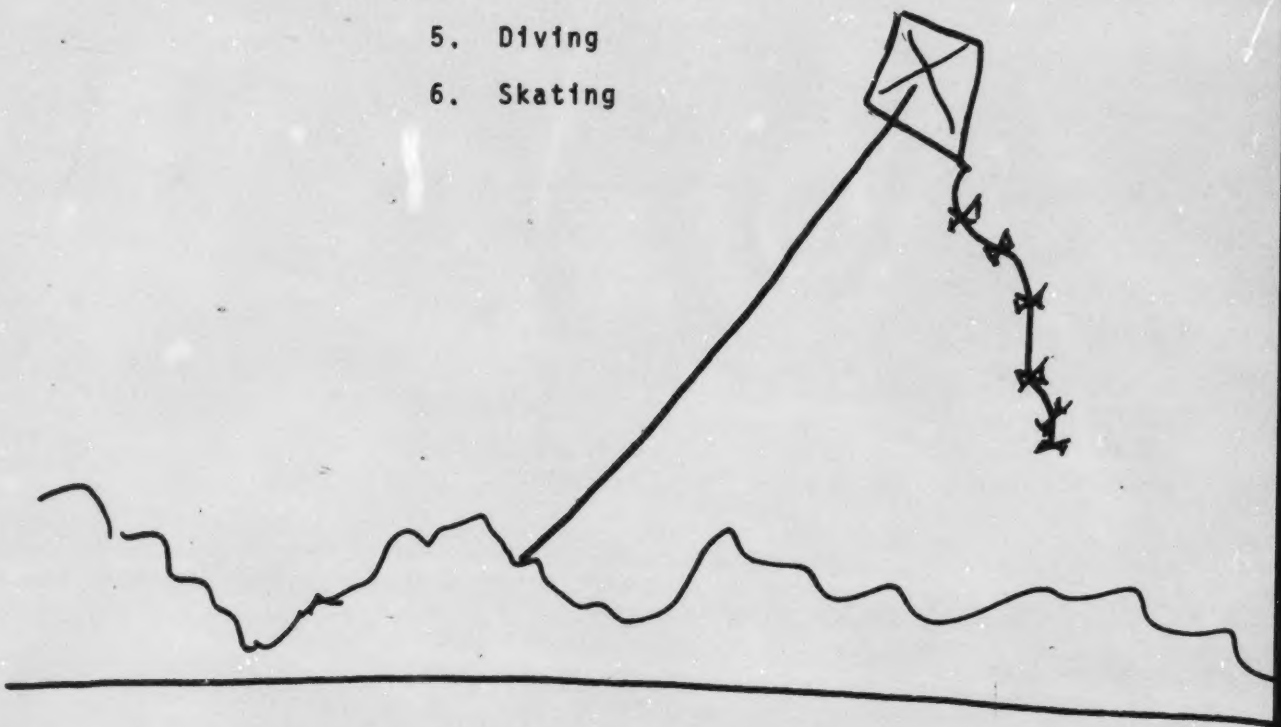
Students will be divided into groups of six.

Make a list of some actions to pantomime or use the list below. If you make your own list be sure your list of words are associated with recreational activities.

Each student will pantomime each action.

Students will discuss the different ways each action was pantomimed.

1. Flying a kite
2. Climbing a sliding board
3. Dunking a basketball
4. Riding a bike
5. Diving
6. Skating



CONCEPT: SOCIO-LEGAL KNOWLEDGE

OBJECTIVE: The student will be aware that the supply and use of energy is directly related to the world's economic and political well-being.

ACTIVITY: MULTIPLE CHOICE

Nations gain by trading with one another. It is more economical for a nation to specialize and trade freely than to produce everything itself.

Many nations fear that specializing in a few products would make them too dependent on other countries. In case of war, their supplies of essential goods and services might be cut off. Some argue that their country should develop its own industries to compete with foreign industries. Foreign producers might gain monopolies over certain products and raise prices. Many feel a nation can increase employment and help avoid depressions by limiting imports and developing its own industries.

The United States and many other countries have worked to increase world trade. In 1957, six European nations formed the European Economic Community. This organization seeks to remove all trade barriers between member nations.

AFTER READING THIS ARTICLE, COMPLETE THE ACTIVITY ON THE NEXT PAGE.

In the following exercise, each statement has something missing. Several possible answers are given under each statement. Show that you know which answer should be in the blank by drawing a circle around the correct answer. Refer to the article you have just read for information.

1. _____gain by trading with one another.

   a. cities b. people c. nations

2. The United States and other countries worked to increase world _____.

   a. trade b. population c. money

3. A nation can increase employment and help avoid _____.

   a. depressions b. war c. leisure time

4. Specializing in a few products would make a nation too _____on other countries.

   a. rich b. poor c. dependent

CONCEPT: SOCIO-LEGAL APPLICATION

OBJECTIVE: The students will maintain files of newspaper clippings and magazine articles related to the supply and use of energy to determine the impact on their community, state, nation and the world.

ACTIVITY: STUDY CHARTS

Students will complete the chart below as they collect newspaper clippings and magazine articles related to the supply and use of energy to determine the impact on their community, state, nation and the world.

NAME:	Information obtained and the source	Impact
COMMUNITY		
STATE:		
NATION		
WORLD		

CONCEPT: SOCIO-LEGAL VALUES

OBJECTIVE: Students will compare energy uses in their homes and community.

ACTIVITY: NEWS GUMBO - USING THE NEWSPAPER

I. The student will clip five pictures with cations along with the accompanying article for each picture. The student will be sure that the articles are related to the use of energy in the home and community.

II. The student will cut the article apart from the caption and picture.

III. The student will place the articles and pictures into a folder or envelope.

IV. Students will trade folders and attempt to place articles with the corresponding picture.

V. Students will compare the different types of articles.

TABLE OF CONTENTS

ENERGY CONCEPT (Teaching Skill)	
OBJECTIVE:	page #

CONSUMER KNOWLEDGE (Problem Solving)

The student will become aware that knowledge of energy conservation affects consumer behavior.....1

CONSUMER APPLICATION (Gathering Information)

The student will be aware of the need for an energy efficient home, car and school.....8

CONSUMER VALUES (Discussions)

The student will be aware of specific advantages of being efficient in energy use.....9

INDIVIDUAL WELL-BEING KNOWLEDGE (Reading Charts)

The student will be aware of the shortages of our current energy producing resources.....10

INDIVIDUAL WELL-BEING APPLICATION (Conclusions)

The student will understand the advantages of conservation to individual and group well-being.....12

INDIVIDUAL WELL-BEING VALUES (Listing)

The student will know the effects of energy efficient usage and the effects of inefficient energy usage on individual well-being.....13

CAREER KNOWLEDGE (Conclusions)

The student will know the changes in career opportunities with the changing patterns of energy usage.....14

CAREER APPLICATION (Applying new knowledge)

The student will demonstrate an understanding of the effects of the energy shortage on his own career choice.....16

CAREER VALUES (Interviewing)

The student will understand how the energy shortage has already affected careers.....17

RECREATIONAL KNOWLEDGE (Discussions)

The student will become aware that energy shortages and changing patterns of use affects the recreational activities of all people.....18

RECREATIONAL APPLICATION (Brainstorming)

The student will list and compare energy efficient vs. inefficient recreational activities.....19

RECREATIONAL VALUES (Discussions)

The student will identify changes which have occurred and project future changes in his/her lifestyle as a result of energy conservation.....20

SOCIO-LEGAL KNOWLEDGE (Using the Newspaper)

The student will understand that changing patterns of energy consumption affect individual lifestyles and the world society.....21

SOCIO-LEGAL APPLICATION (Research)

The student will list at least two major changes in laws or customs which have taken place in the areas of transportation, housing and recreation as a result of energy shortages.....22

SOCIO-LEGAL VALUES (Forming Hypothesis)

The student will project changes in the laws that might occur with our changing energy situation.....23

CONCEPT: CONSUMER KNOWLEDGE

OBJECTIVE: The student will become aware that knowledge of energy conservation affects consumer behavior.

ACTIVITY: PROBLEM SOLVING

1. AMERICA'S ENERGY FOUNDATION . . . THREE FOSSIL FUELS

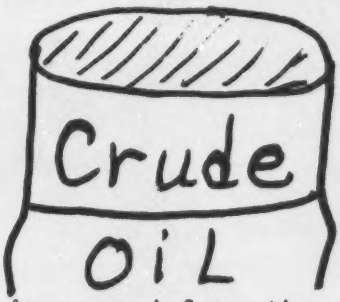
Fossil fuels---oil, natural gas and coal- provide more than 90% of our energy.

Most scientists agree that these fuels had their beginning millions of years ago. They were formed gradually over thousands of years from the remains of prehistoric plants and animal life. For example, oil and natural gas were formed from tiny marine animals and plants which died and collected in layers on the sea's floor. Coal was formed from decayed trees and other plants of ancient forests that also accumulated in layers. Through the ages, heat from decay, pressure from earth or sea and other factors helped to change the plants and animals into fossil fuels.

The important thing about the formation of fossil fuels is that: energy from the sun was absorbed by the animal and plant life and lay trapped in the deep buried layers. We don't know exactly how much of these fuels remain in the earth. We do know that we have already found and removed those which were easiest to reach.

OIL

Oil was found in the United States in the early 1800's when people were drilling salt wells. A scientist at Yale University was convinced that the thick oily liquid could be valuable for many uses. He was right. After the first oil well was drilled in Titusville, Pennsylvania in 1859, an important American industry was born.



Oil as it is pumped from the ground is called crude oil. Crude oil is also known as petroleum. It is moved by pipeline, highway or railroad tank cars, ocean tankers and barges to refineries. Before it can be used for energy or other products it must be processed at a refinery.

At the refinery complicated equipment is used to separate the crude oil into different fuels and by-products. Gasoline for our cars is one of the most important fuels from crude oil. Uses for other fuels are shown above. Some oil is also used to heat and to run generators to produce electricity.

In addition to being used as a primary source of energy

more than 3,000 other products are made from petroleum.

The U.S.S.R. is the world's largest producer of petroleum, followed by Saudi Arabia, the United States, Iran and Venezuela. In the United States the states which produce the most are Texas, Louisiana, California, Oklahoma, Wyoming, New Mexico, Kansas and Alaska.

NATURAL GAS

Natural gas is not the same as the gasoline you put in your car. You cannot see natural gas, but you can see the blue flame when it is burned.

Natural gas was discovered in 1821 when it was noticed causing bubbles in a creek in Fredonia, New York. The bubbles were found to burn and another useful energy source was discovered. In 1858 the first natural gas company was formed.

Today, natural gas is found by drilling, though it is not as easy to find as it once was. It is sometimes located in the same places as oil but not always. Gas is carried to pipelines across the country to the communities or industrial plants where it is needed.

Natural gas is the most widely used fuel for heating homes and many schools and other buildings. Gas ranges are used for cooking in many homes and restaurant kitchens.

COAL

Coal is black or dark brown. There are two main kinds. Bituminous coal is called "soft" coal because it is easy to break up. We have more of it than any other kind. Anthracite is a much harder coal. There is not much of this kind left in the United States.

Coal was used by American Indians to make heat to bake their pottery. The first colonists used coal in their blacksmith shops as they had done in England. But they usually burned wood from the forests to heat their homes and cook their food.

MINING METHODS

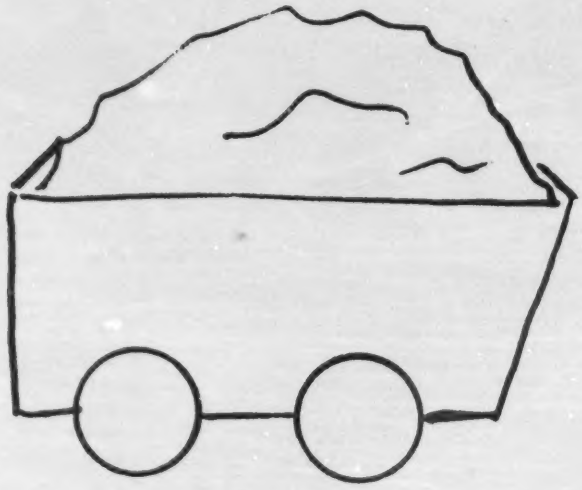
When coal is close to the surface it is removed by strip mining. Giant power shovels and other equipment remove layers of the earth and rock to expose the coal. When the coal lies deep in the earth it must be removed by one of the methods of underground mining.

One of the problems in mining coal is the damage it does to the land. Today, however, industry takes steps to put the mined areas back into useful shape. This program is called reclamation. Reclaimed land has been used for parks, farms, housing developments and game preserves.

USES FOR COAL

Coal is burned to heat some homes, schools and other buildings. It is used to produce more than half of our electricity. Coal is important in the production of steel and provides energy for many other kinds of industries. As with petroleum, the chemicals in coal are used in many everyday products. Some examples are medicines, plastics, fertilizers and detergents.

Additional research is being done to find new uses for coal because it is more plentiful than other fossil fuels.



ACTIVITY II

WHAT YOU AND YOUR FAMILY CAN DO...

ABOUT THE ENERGY CRISIS

American business and industry use a lot of energy to give us the things we want for our way of life. They use it to produce our food, clothes, TV sets, refrigerator, toasters, cars and other products. They use it to ship those products to us. You probably can't do much to save energy used by industry. But the people who work in industry can and many are doing so. Where you and your family can help is with the energy used at home, or in fuel for personal cars.

Suppose each student in your class decides to start a family energy saving campaign. Then suppose each family influences another family to do the same. As the idea spreads, two things will happen. Your family will save money on its fuel bill. Your community will be making a definite contribution in helping to prevent a more serious energy crisis. Here are four steps to help you get started.

I. MAKE AN ENERGY INVENTORY:

Ask someone at home to help you. Take a notebook and walk from room to room. Write down all the things that use any kind of energy. Maybe you will want to list the things under headings, such as these: large appliances, small appliances, lighting fixtures, entertainment equipment, etc. If you live in a house, list electrical equipment outdoors.

II. HAVE A FAMILY ENERGY CONFERENCE:

Go over the energy inventory. Talk about all the ways the family can think of to save energy with each item on the list. Here are a few examples:

Turn off radios, televisions, and record players promptly when nobody is listening to them.

Avoid unnecessary opening of the refrigerator or freezer door. Leaving the door open while you "think" allows more air inside and the appliance uses more energy to cool down again.

Turn lights off when not needed. Use light bulbs of lower wattage for the areas of the house where you aren't reading.

Avoid unnecessary use of the car. Take care of several errands on one trip. Walk or ride a bicycle when possible.

Try not to walk in and out of the house more often than necessary. Close outside doors promptly.

III. COLLECT ENERGY SAVING IDEAS:

Share ideas with others in your class. Create an "Energy Saving Center" in class with a bulletin board and library. Local utility companies may be able to furnish helpful booklets or posters. Look for ideas everywhere and take them home.

IV. HAVE ENERGY CHECKUPS:

When you start your energy home projects, write down the amount of the last bill for gas and electricity. If the family has a car, get an estimate of the gallons of gasoline used in a one-month period. See whether the family would like to set a goal of using 5% less energy. Check the bills each month to see if the goal is being met.

Plan a school display or a newspaper story about the class energy project. Show the community how one group of families is trying to help with the energy crisis.

CONCEPT: CONSUMER APPLICATION

OBJECTIVE: The student will be aware of the need for an energy efficient home, car and school.

ACTIVITY: GATHERING INFORMATION

Suppose there is a 24-hour blackout in your city or town. List five ways it might affect your life at home. List five ways it might affect the school. List five ways it might affect the "life" of the city as a whole.

Interview a senior citizen about recollections of energy at home and school when he or she was your age. For example: explore how rooms were heated; what jobs were done by hand that are now accomplished with electrical power; what fuel was used in stoves to cook food; how laundry was done; and what transportation systems were like.

CONCEPT: CONSUMER VALUES

OBJECTIVES: The student will be aware of specific advantages of being efficient in energy use.

ACTIVITY: DISCUSSIONS

Discuss each of the following:

1. The definition of the word consumer.

2. What are ways to be energy efficient?

3. What are the advantages of being energy efficient?

4. What are the disadvantages of being energy efficient?

5. What additional information can you provide about using energy efficiently?

6. How do your answers to questions 1,2,3,4,and 5 affect the total use of energy?

CONCEPT: INDIVIDUAL WELL-BEING KNOWLEDGE

OBJECTIVE: The student will be aware of the shortage of our current energy producing resources.

ACTIVITY: READING CHARTS

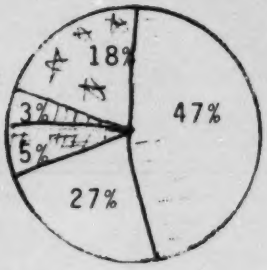


CHART A

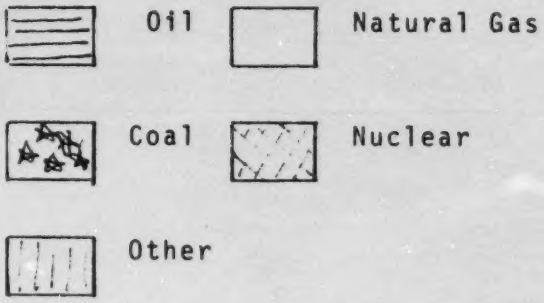


CHART A SHOWS THE ENERGY RESOURCES USED IN THE UNITED STATES IN 1976

CHART B

RESOURCES	Years at current rate of use	% of increae of usage	Years with increased usage
Natural Gas	38	4.7%	22
Oil	31	3.9%	20
Coal	2300	4.1%	111

Chart B shows the number of years that energy producing resources will last at the current rates of usage, the projected increase of usage of these resources, and how long these resources will last with the projected increase of usage.

USE CHARTS A AND B TO ANSWER THE FOLLOWING:

1. List the three major resources the United States uses to produce its energy.

2. What are the projected number of years these resources will last at current rates of usage?

3. How long will these resources last if we continue to increase our usage of them?

CONCEPT: INDIVIDUAL WELL-BEING APPLICATION

OBJECTIVE: The student will understand the advantage of conservation to indivdiual and group well-being.

ACTIVITY: DRAWING CONCLUSIONS

USAGE:	% OF ENERGY USED
Transportation	32%
Household: Commercial	32%
Industry	36%

1. Using this chart, what % of energy usage can you effect in your daily life?

2. Since you know how short the current energy resources are and the % of energy usage you as an individual have control over, write an essay which expresses the importance of energy conservation to your individual well-being.

3. What conclusions can you make about the importance of individual energy conservation of this country's well-being.

CONCEPT: INDIVIDUAL WELL-BEING VALUES

OBJECTIVE: The student will know the effect of energy efficient usage and the effects of inefficient energy usage on individual well-being.

ACTIVITY: LISTING

	EFFICIENT	INEFFICIENT
Housing		
Transportation		
Recreation		

1. Fill in the above chart with the effects on individual well-being of using energy efficiently and inefficiently in the areas of housing, transportation and recreation.

2. When you have a choice, will you choose energy efficient or inefficient usage? Explain your choice in terms of:

   a. your own individual well-being and

   b. the United States' future well-being.

CONCEPT: CAREER KNOWLEDGE

OBJECTIVE: The student will know the changes in career opportunities with the changing patterns of energy usage.

ACTIVITY: DRAWING CONCLUSIONS

GNP stands for Gross National Product. This is the total dollar value of all goods and services produced by the United States in one year. The more we produce, or the higher the GNP, the more energy we use. The problem of the shortage of our current energy producing resources will require changes in our use of these resources and development of new energy resources.

These requirements will affect wise career choices of the future.

BELOW IS A LIST OF CAREERS WHICH WILL EITHER INCREASE OR DECREASE IN DEMAND AS A RESULT OF THE SHORTAGE OF CERTAIN ENERGY RESOURCES. Label each to show if it will increase or decrease our resources:

Petroleum Engineer _____

Environmental Engineer _____

Soil Conservationist _____

Oil Refinery Operator _____

Gas Company Inspector _____

Coal Miner _____

Gas Station Attendant _____

Nuclear Technician _____

Oceanographer _____

Solar Energy Engineer _____

1. Using the list of careers on the preceding pages list 3 careers that will be reduced in demand in the future because of shortage of certain energy resources and list 3 careers that will increase in demand. Give reasons for all of your choices:

CAREER Reasons

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

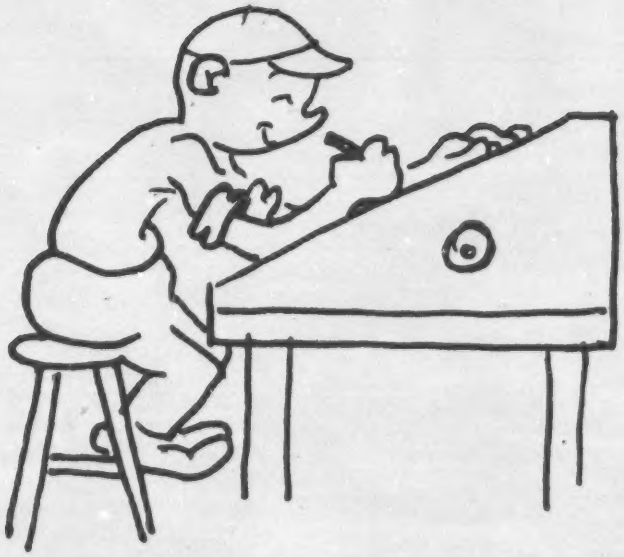
Option: Make a mobile or collage showing at least 5 careers that will be reduced in demand in the future because of the energy shortage. Make a mobile or collage of 5 careers that will increase in demand as we meet the requirements of the energy shortage.

CONCEPT: CAREER APPLICATION

OBJECTIVE: The student will demonstrate an understanding of the effects of the energy shortage on his own career choice.

ACTIVITY: APPLYING NEW KNOWLEDGE

With your understanding of how the energy problem will effect careers in the future choose a career you are interested in and explain why you think that career will still be a needed career in the future.



CONCEPT: CAREER VALUES

OBJECTIVE: The student will understand how the energy shortage has already affected careers.

ACTIVITY: INTERVIEWING

1. Interview your parents to find out how energy concerns have affected their jobs. Make a list of at least 5 quesions in class which will help you determine if your parents' jobs have been affected by the rising cost of energy.

2. Call the personnel service office of three major companies to find out if the energy program passed by Congress in the Fall of 1978 or the energy shortage has caused any changes in the number and kinds of jobs they have. If possible, call energy related companies such as oil companies, gas companies, electric companies, etc. Make sure to write your questions in advance. Make sure you record the answers accurately.

CONCEPT: RECREATIONAL KNOWLEDGE

OBJECTIVE: The student will become aware that energy shortages and changing patterns of use affects the recreational activities of all people.

ACTIVITY: DISCUSSION

Discuss each of the following with classmates:

1. Define recreation.

2. List types of recreation and/or list areas of recreation.

3. What changes do you foresee as the energy crunch gets worse?

4. What is the value of recreation to you?

CONCEPT: RECREATIONAL APPLICATION

OBJECTIVE: The student will list and compare energy efficient versus inefficient recreational activities:

ACTIVITY: BRAINSTORMING

Divide the class into groups of four to determine as many kinds of recreational activities as possible. These should then be prioritized from the one requiring the most energy to the one requiring the least amount of energy. Each group should report back to the total class and then the class should arrive at a consensus.

CONCEPT: RECREATIONAL VALUES

OBJECTIVE: The student will identify changes which have occurred and project future changes in his/her recreation lifestyle as a result of energy conservation.

ACTIVITY: Discussion

1. Based on your knowledge of the energy shortages and class discussions, what changes do you foresee in your own recreational lifestyle?

2. How do your own feelings regarding the use of energy for recreation affect the total consumption of energy?

CONCEPT: SOCIO-LEGAL KNOWLEDGE

OBJECTIVE: The student will understand that changing patterns of energy consumption affect individual lifestyle and the world society.

ACTIVITY: USING THE NEWSPAPER

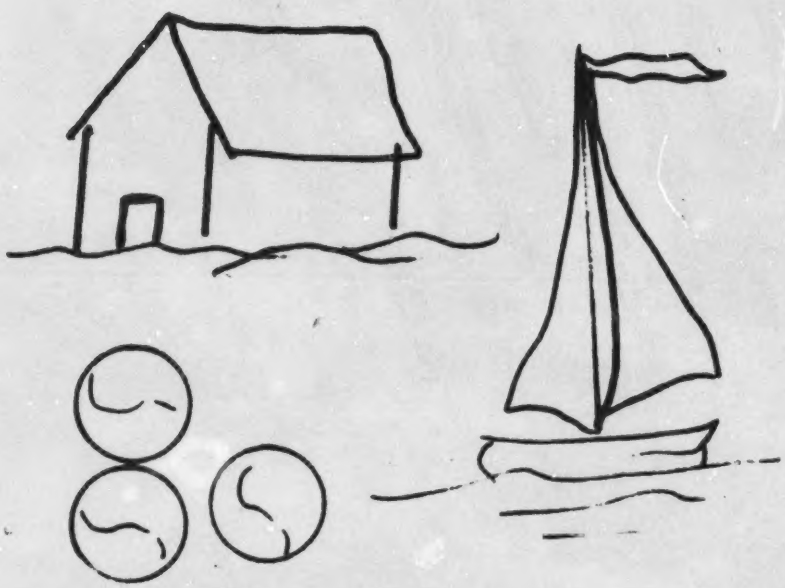
Collect energy related news items from the newspaper for a period of 2 weeks. Select from the articles incidents which relate to changing patterns in lifestyle due to energy shortages.

CONCEPT: SOCIO-LEGAL APPLICATION

OBJECTIVE: The student will list at least two major changes in laws or social customs which have taken place in the areas of transportation, housing, and recreation as a result of the energy shortage.

ACTIVITY: RESEARCH

The student should review the present legal status of energy and write an editorial opinion.



CONCEPT: SOCIO-LEGAL VALUES

OBJECTIVE: The student will project changes in the laws that might occur with our changing energy situation in the areas of housing, and transportation.

ACTIVITY: FORMING HYPOTHESIS

At the present time, the United States depends on oil and natural gas for 74% of their energy needs. The supply of these fossil fuels is running very low. As the world begins to run out of these fuels alternative sources of energy must be used. What are possible alternatives?

I. OTHER FOSSIL FUELS:

A. COAL: The United States has a very large supply of coal. Presently, coal provides only 18% of national energy needs. One obvious solution, for the short term, is to use coal where oil or natural gas are now being used.

PROBLEMS:

1. Much of the United States coal is very high in sulfur content. In order to control pollution, this coal requires an expensive filtering system to remove the sulfur.

2. Mining coal is also a problem. There are two basic ways to mine coal. One is surface mining or strip mining. This is where one digs a very large hole in the ground down to the coal. This usually means destroying acres of land. To refill and refurbish the land requires a great deal of money. There is some question as to whether this can really be done successfully. The second way to mine coal is deep mining. This is where miners dig a small shaft down to the coal and dig out the coal. This forms tunnels underground. The problems mainly involve the safety of the miners. There is a constant danger of cave ins and breathing coal dust.

Over extended periods of time, this causes black-lung disease.

B. OIL SHALE: This is a special kind of rock which contains a substance known as kerogen. Kerogen is actually partially formed oil. The amount of oil locked in the oil shale is about 20 times that of our known oil reserves. The oil shale is promising, but there are problems.

PROBLEMS:

1. The process for removing oil from oil shale is not perfected and is very expensive.

2. There is the ecological problem of what to do with shale after the oil is removed.

3. The process for removing the oil requires large amounts of water. Water is relatively scarce in areas where the oil shale is located.

II. SOURCES OF ENERGY OTHER THAN FOSSIL FUELS:

A. GEOTHERMAL:

This basically is using the earth's own internal heat to produce electricity. This has already been done in several areas of the western United States where geysers (underground water heated by the hot rock beneath the earth's surface sprays to the surface) are tapped and the steam is used to produce electricity.

Problems:

1. The heat is so extreme it can easily melt valves in the drilling and pipeline assembly.

2. This type of energy production is limited to areas where the hot rock is close enough to the surface to be reached by current drilling techniques.

3. Drilling down to the hot rock is much more expensive than drilling in our current oil fields, which makes the electricity produced expensive.

B. Nuclear: Electricity is produced by running water around the nuclear reactor which is very hot. This turns the water into steam which is then used to turn turbines and produce electricity. This is a very promising source of energy because so little uranium is used to produce a much larger quantity of electricity. The problems, however, are very dangerous.

PROBLEMS:

1. The waste from the reactor is radioactive and can cause radiation sickness leading to death. How to safely dispose of this waste is a major difficulty.

2. The radiation from the nuclear reactors causes the internal pipes in the reactors to wear out very quickly. Without the supply of water to cool the reactor, it would explode like an atom bomb. If the pipes supplying water should burst, there is a built in secondary system. However, these secondary systems have to pump water into the reactor under very high pressure. They have had serious problems with these systems being unable to pump the water into the reactor during test.

C. SOLAR: There are two basic ways to use solar energy. One is to concentrate the sun's energy, like a magnifying glass does, and use it to heat water to form steam which turns a turbine, producing electricity. The second way is to use a photovoltaic cell which turns sun light directly into electricity. Solar energy appears to be the answer to our energy shortage because there is no shortage of sunshine, but there are some problems.

Problems:

1. During times when the sun is shining, batteries must store enough electricity for use when the sun is not shining. At the present time the batteries are not efficient enough to do this economically. In other words, it takes so many batteries to store the necessary energy

that it makes solar power very expensive.

2. Solar power would probably have to be restricted to areas where the sun shines almost year round.

3. The photovoltaic cells are too expensive to make solar power economical.

Keeping alternative energy resources in mind, propose two laws which could be passed in the future to answer energy needs. Keep in mind the problem of "economical" energy and the National energy program that was passed in 1978.

147.

A PRINCIPALS ROLE IN ENERGY SAVINGS

The National Energy Plan states the U.S. and the world are in the early stage of an energy transition. This transition springs from the need to adjust to scarcity & high prices. Unless the U.S. makes a timely adjustment before world oil becomes very scarce and very expensive in the 1980's the nation's economic security and the American way of life will be gravely endangered. (Federal Energy Plan.)

Energy consumption and production data for 1978 are available and they indicate some changes in the U.S. energy consumption patterns. Overall deoestic energy consumption increased from 76.6 QBtu in 1977 to 78.0 QBtu in 1978. This reflects an increase of 1.9% over 1977.

President Carter makes it clear that the rapid use of non-renewable energy sources is not a short term crisis but a long term situation that requires treatment of the cause. The long term (1000 years) solution will no doubt be electricity from solar or some other energy source. The interum solution while the oil barrel runs dry requires modification by the classroom teacher to effect the changes that will result in a change of our current life style and a new energy use ethic. The old quick fix solution of add a module or a three week unit on energy has not been effective in creating the changes in life style restricted energy sources will create. It is now the responsibility of the principal to again take a leadership in helping the school become an energy laboratory to model the most effective energy savings behavior.

A possible solution comes from the principal and building manager for a school. A solution is the establishment of the school as an energy laboratory. Borrowing from the past success where the school became a focus for community efforts to meet critical shortage needs. It is clear that the school is needed again. The establishment of an effective energy lab-

oratory requires the full participation of all participants in the school. The principal can organize the school as a working unit to increase the conservation practices of the schools. The school custodians, teachers and students must have a role in suggesting and implementing conservation practices.

In making any changes that will vary the room temperature twenty degrees from 70 F, you would be wise to consult a contractor to determine if the temperature change will adversely affect the floors, especially in gyms, wall paint or coverings, water pipes, and the water recepticles.

1. Unplug all water coolers. (Consider placing on a seperate circuit for easy disconnecting.)
2. Turn off all unused hot water heaters ... kitchen, Home Economics labs, bathrooms. The best system allows a small auxillary system for only the most necessary uses during off times. For example: a small hot water system may be used in the field house to wash towels during the summer, but if a large number of showers are not necessary, don't hear the water.
3. Turn off all heating and cooling units when possible, set the theromstat at lowest setting. Run heating only in necessary areas.
4. Check custodial schedules. Have cleaning during the day to use natural light. Keep heating to a minimum.
5. Talk to your local power company and inform them of your energy reduction. This may allow you to eliminate some fuel surcharges. Every power company has variable rates, but contact your local source and determine the effect on you. Lower energy use may not mean a reduced bill.
6. Lighting should be minimal--place all outside lights on timers,

reduce 24 hour inside lighting.

7. Unplug office copier machines, coffee makers, soft drink machines, candy machines and any other small appliances during your time away from school.

Responsibility to make actual cut off requires more work for the staff, but it reinforces your communication with them to seek energy savings.

The Cafeteria--check the following items:

Hot water--cut off or reduce temperature

Vending machines

Lighted signs, any food dispensers

Cold water fountains

Investigate the storage of all foods in a central cold locker and cut off power to others.

Ranges, diswashers and other appliances turned off and not using power.

Consider elimination of natural gas pilot lights and substitute electric pilot lights.

A quick check for wind infiltration on windows and doors is to close a dollar bill in the frame, if it can be pulled out easily, you need to improve weather stripping.

Transportation:

1. Have all vehicle keys checked in for the holidays.
2. Have locking gas caps on all vehicles.
3. School shops are high power factor areas due to the number of electric motors. Ask the shop teacher to unplug all power tools and air compressors.

4. Home Economics can place all foods in one refrigerator and unplug others.

5. Art teachers can help by reducing hot water and electrical demands.

Make your school an energy saver this vacation and tell the public how much you appreciate your faculty and students for their leadership. The community can learn some valuable energy savings tips from the educational leaders. Remember, the energy we save today may be around to use later.

Quick Fix Energy Checklists

for Region VII Education Service Center School Administrators

This section provides three checklist to be reproduced by each participant relative to Electricity and Heating, Ventilation and Air Conditioning, and Transportation. In addition a special section for secondary schools by subject matter is provided. This activity should be intergrated with a discussion of priorities and how to manage the local problem of energy use.

It is the goal of this activity to solicit comments and discussion about what each school can do. An energy audit is available from the governors' council of energy resources or the local power companies. School administrators may use these checklists in developing a management plan for their school.

Quick Fix Energy Saving Measures
in
ELECTRICITY AND LIGHTING
for
Region VII Education Service Center Admininstrators

There has been a constant escalation of electrical use in schools for the past thirty years. Lighting levels have tripled, air conditioning is commonplace and the current trend in school architecture is to build climate controlled, sealed environments. These trends have resulted in the situation where over ninety percent of the school's electrical budget is used for lighting and climate control. The practices listed on the checklist are a compilation of suggestions from the Department of Energy, Ventura County Schools, and the Texas Governors' Council of Energy Resources as effective in reducing this huge energy drain. Some of these practices represent a departure from traditional procedures. Because every school is different you should conduct a complete energy audit for a better view of your school. The basic need for reading is 50 foot candles. Consider windows, skylights and other natural systems to supplement your lighting system. The best practice is one which involves changes in behavior of the responsible people. Involve students, teachers, and maintenance personnel to change their actions toward a more energy conservation consciousness.

Quick Fix Energy Saving Measures
for
ELECTRICITY AND LIGHTING
in
Region VII Education Service Center Administrators

Please place a check in the appropriate column for each item.	Current Practice	Possible Practice	Next Step
1. Secure electrical energy utilization data to individual school each month.			
2. Replace indoor and outdoor incandescent lighting with florescent tubes or mercury vapor lighting.			
3. Replace florescent tubes after 80% of their lamp life.			
4. Clean florescent tubes at least every six months.			
5. Lower the temperature setting for electric hot water heater to the lowest level acceptable.			
6. Turn lights off in unused classrooms.			
7. Reduce lighting levels in cafeterias, gymnasiums, common areas and halls to lowest levels based upon safety requirements. 50 foot candles or less.			
8. Reduce excessive holiday lighting.			
9. Eliminate all possible lighting during non-use hours.			
10. Instruct night custodians to light only the rooms and areas they are cleaning at the time.			
11. Use only full washer and dryer loads in school laundries.			

Developed by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Next Step
12. Schedule daylight cleaning when possible.			
13. Reset automatic times regularly to utilize all available daylight.			
14. Turn off electric typewriters and other clerical equipment when not in use.			
15. Reduce use of appliances, coffee pots, and room heaters.			
16. Restrict use of parking lot lights to times when school activities are held.			
17. Schedule meetings into facilities of proper size.			
18. Paint walls, and ceilings with light reflective colors.			
19. Investigate the use of dimmer switches and separate lighting circuits for areas which are not in constant use,			
20. Install switches in rooms so that light near windows can be turned off when there is sufficient natural light.			
21. Sub-meter electricity so that a true charge by building can be determined.			

Devleoped by R.M. Jones and Mike Owens

Quick Fix Energy Saving Measures for

HEATING, VENTILATION AND AIR CONDITIONING
in
Region VII Edcation Service Center Administrators

The Ventura County publication made the point that "The prevailing temperatures in today's classrooms are a product of our culture and not requirements of our bodies. Nor does lowering the temperature in winter or increasing it in the summer to current recommended energy-saving levels effect health, learning or achievement." While some practices in this area are also effective in electrical energy savings, the complex intermingling of natural gas, fuel oil, and steam with electrical energy generation require specific considerations in how we heat and cool our schools. The practices listed on the checklist are a complication of suggestions from the Department of Energy, Ventura County Schools, and the Texas Governors' Council of Energy Resources as effective in reducing this huge energy drain. Some of these practices represent a departure from traditional procedures. Because every school is different you should conduct a complete energy audit for specific changes in equipment and construction. These suggestions involve little or no cost.

Quick Fix Energy Saving Measures
in
HEATING, VENTILATIONA AND AIR CONDITIONING
for
Region VII Education Service Center Administrators

Please place a check in the appropriate column for each item.	Current Practice	Possible Practice	Not Currently Feasible
1. Minimize utilization of portable heating and cooling units.			
2. Establish appropriate local settings in all classrooms.			
3. Regularly check the accuracy and efficiency of all temperature controls.			
4. Investigate the utilization of natural heating and cooling cycles through ventilation and open window controls.			
5. Do not restrict air flow around thermostats, and vents.			
6. Do not change thermostat settings to increase rate of cooling & heating.			
7. Shut off or put on automatic night time setback all heating, cooling and equipment during non-school hours and vacations.			
8. Investigate the use of drapes and blinds for passive thermal control.			
9. Conduct staff inservice on the operation of heating, cooling and ventilation controls.			
10. Conduct regular inspection, cleaning and maintenance of all heating, cooling and ventilation systems.			

Developed by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Not Currently Feasible
11. Consolidate summer school classes, night classes, and meetings in adjacent rooms to eliminate excess air conditioning.			
12. Install automatic door-closing devices.			
13. Close or cover baffles and vents on cooling systems during the heating season.			
14. Investigate the use of heat recovery devices to utilize exhaust air.			
15. Implement a cooperative information program to inform children and parents about proper seasonal dress.			
16. Investigate the use of solar energy as a supplementary heating source.			
17. Check for leaks in weather stripping around windows and doors.			
18. Keep thermostats free of direct sun and heat producing lamps or appliances.			

Developed by R.M. Jones and Mike Owens

Quick Fix Energy Saving Measures
in
TRANSPORTATION
for
Region VII Education Service Center Administrators

The school has accepted the responsibility of transporting students to its facilities, on field trips, to athletic events and to extra-curricular activities of a broad nature. In addition, more and more students, faculty and staff are driving their personal vehicles to school and on school business. Staff inservice, student transportation programs and volunteer vehicle sharing can have enormous impact on our utilization of gasoline and other petroleum products. The practices listed on the checklist are a compilation of suggestions from the Department of Energy, Ventura County Schools, and the Texas Governors' Council of Energy Resources as effective in reducing this huge energy drain. Some of these practices represent a departure from traditional procedures. Because every school is different you should consult all persons involved in transportation to develop realistic goals and plans.

Quick Fix Energy Saving Measures
in
TRANSPORTATION
for
Region VII Education Service Center Administrators

Please place a check in the appropriate column for each item.	Current Practice	Possible Practice	Next Step
1. Review security procedures for all vehicles, storage tanks, and pumping facilities.			
2. Conduct inservice for all drivers and maintenance personnel on fuel efficient operation of vehicles.			
3. Utilize trip recorders or logs to record vehicle operation data.			
4. Utilize a central vehicle checkout operation data to consolidate trips.			
5. Investigate the utilization of intermediate size buses and vans for small group transportation.			
6. Develop incentive programs for walking, bicycling, and car pooling for students and staff.			
7. Investigate changing attendance boundaries to reduce trip distances.			
8. Reduce school year to minimum number of days legally mandated.			
9. Combine field trip requests from more than one class or school to insure full bus loads.			
10. Coordinate athletic even schedules to allow several teams to travel together in vehicles.			

Developed by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Next Step
11. Investigate sharing vehicles with neighboring districts for all athletic and scholastic events.			
12. Encourage employees to eat lunch on campus or at their work station.			
13. Use closed circuit televeision or conference calls for staff meetings.			
14. Have regular maintenance of vehicles including change of air cleaner.			
15. Install cruse controls on vehicles and set governors at a maximum of 55 mph., 50 mph. for school buses.			
16. Remove unnecessary weight from vehicles.			
17. Purchase small energy efficient cars for staff use.			

Developed by R.M. Jones and Mike Owens

ADMINISTRATIVE CHECKLIST
FOR SECONDARY CLASSROOMS

Please use these with your staff to determine current prodecures.	Current Practice	Possible Practice	Next Step
HOME ECONOMICS 1. Decrease the amount of hot food prepared.			
2. Limit pre-heating of ovens to the very minimum. In some cases, pre-heating is not necessary.			
3. Use microwave ovens whenever feasible.			
4. Redesign curriculum to have students take more classes at home or do part of cooking as a home activity.			
5. Utilize the food prepared by students for student or faculty meals.			
6. Use manual defrosting rather than automatic defrost equipment.			
7. Do dishwashing by hand with small amount of dishes. Operate dishwater only with full loads.			
8. Fill washers and dryers to capacity and promote the use of clotheslines.			
9. Use small appliances in place of large ranges whenever economical.			
10. Use cold-water clothes washing when possible.			
11. Cook by time and temperature for best results. Use minute timer for precise cooking operations.			

Developed by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Next Step
12. Don't open oven doors more than necessary to check on foods being prepared.			
13. Keep pots and pans covered while cooking whenever possible.			
14. Make sure burners are completely off when not in use.			
15. Use a stopper in sink when washing dishes by hand to avoid running hot water continuously.			
16. When washing clothes, use the correct cycle.			
17. Don't overload dryers. Avoid overdrying clothes.			
18. Clean lint screen in dryer regularly.			
19. Lower temperatures in water heaters on weekends; turn off during vactions.			
20. Match pan size to burner unit size.			
21. Refrigerator and freezer should be kept more than half full. Items absorb and help hold cold.			
22. Use high heat only to bring water to a boil or to start cooking food with water. Then reduce heat level to lowest possible point.			
23. Have all ovens calibrated.			
24. Keep refrigerator and freezer coils clean; replace door seal when it no longer seals tightly.			
25. Consolidate baking activities into one day of continuous use.			

Developed by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Not Currently Feasible
26. Put window in all oven doors to avoid opening to check status of food.			
27. Use hood fans only when necessary.			
28. Turn off pilot lights.			
29. Eliminate the use of electric can openers.			

Driver Training

	Current Practice	Possible Practice	Not Currently Feasible
1. Reduce total mileage driven, reduce behind the wheel time, and reduce the amount of freeway driving time.			
2. Use smaller cars with lower horsepower.			
3. Use more efficient model cars with four or six cylinders, stick shifts and less power equipment.			
4. Vehicles should be equipped with steel belted radial tires with more air pressure in tires to reduce gasoline consumption.			
5. Pretest students and give credit for previous training and experience. Reduce hours based on results of pretest.			
6. Reduce maximum speed to most efficient operating speed for engine involved.			
7. Increase use of simulators to reduce behind the wheel training.			

Developed by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Not Currently Feasible.
8. Restrict driver training use of vehicle to as limited a geographic area as possible.			
9. Operate driver training vehicle with full passenger load.			
10. Keep vehicles tuned to peak performance.			

Special Education

	Current Practice	Possible Practice	Not Currently Feasible
1. Consolidate transportation routes of special education children to avoid duplicating bus routes.			
2. Develope more flexible starting times to utilize regular bus schedule.			
3. Coordinate shop use and classroom use for more efficient utilization of space in shop area.			
4. Reduce the acreage in student farms.			
5. Restrict use of doors in shops.			
6. Reduce the number of forges, kilns and smelters.			
7. More useful projects in shops to help other departments in the school with equipment repairs, etc...			

Drama

	Current Practice	Possible Practice	Not Currently Feasible
1. Design activities for more efficient use of multi-purpose rooms.			

Developed by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Not Currently Feasible
2. Reduce lighting, especially stage wattage, through the use of dimmer switches.			
3. Increase the number of daytime public performances.			
4. Use only essential amplifying equipment.			
5. Use less and lower lighting during rehearsal.			
6. Schedule more outdoor performances.			
7. Use regular classroom more when smaller groups are practicing or performing.			

Arts & Crafts

	Current Practice	Possible Practice	Not Currently Feasible
1. Reduce hours of kiln use.			
2. Develop block scheduling of class time.			
3. Organize more hand operations, especially in crafts.			
4. Conduct outdoor classes, especially painting and drawing.			

Music

	Current Practice	Possible Practice	Not Currently Feasible
1. Have concerts, both on-site and outdoor performances.			

Devleoped by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Not Currently Feasible
2. Walk or march to some events.			
3. Better utilization of rooms, not using large spaces for small class or individual instruction.			
4. Block scheduling of class time.			
5. (List your own suggestion)			
6. (List your own suggestion)			
7. (List your own suggestion)			

Business Education

	Current Practice	Possible Practice	Not Currently Feasible.
1. Restrict the use of electric typewriters and other electric machines.			
2. To cut down on the use of power equipment, use more hand operated equipment, such as ditto and mimeograph.			
3. Utilize more community and business facilities for training.			
4. Use both sides of all paper products.			
5. Use P.A. system, blackboards, overhead projector, etc..., instead of mimeo or ditto, when there is the need to cut back on the use of paper supplies.			
6. (List your own suggestion.)			

Developed by R.M. Jones and Mike Owens

Adult Education

	Current Practice	Possible Practice	Not Currently Feasible
1. Coordinate adult education classes in one area to reduce the use of heating, air conditioning and electricity.			
2. Schedule adult classes to meet during the day.			
3. Investigate evening use of schools for adult education to the minimum, scheduling classes on the same nights and at the same times as much as possible.			
4. Do a census on location of adult class participants and schedule classes to the nearest locations.			
5. (List your own suggestion)			
6. (List your own suggestion)			

Physical Education and Sports

	Current Practice	Possible Practice	Next Step
1. Install daytime outdoor facilities.			
2. Install water reducers in shower heads to cut down on the amount hot water used.			
3. Lower water temperature in showers.			
4. Put time controls on shower valves to strictly regulate their use.			
5. Put master shut off on shower valves.			
6. Lower swimming pool temperatures.			
7. Minimize filter pumping hours on pools.			

Developed by R.M. Jones and Mike Owens

	Current Practice	Possible Practice	Next Step
8. Use solar heat for heating pools.			
9. Do not heat pools during warm or hot seasons of the year.			
10. Put plastic covers over pools when not in use. Enclose pools when possible.			
11. Keep gym temperature at 65 degrees or below.			
12. Implement block scheduling of class time two days a week.			
13. Utilize commercial laundering of towels.			
14. Limit the geopgraphical area of athletic competitions to reduce traveling by bus or car.			
15. Expand inter-mural competition to substitute for intra-mural.			
16. Conduct basketball, volleyball and other game practice sessions outside as much as possible and during daylight hours.			
17. Combine girls and boys sports as much as possible to reduce the number of hours facilities are used.			
18. Shut off air-handling units and lights in gyms when physical education classes are being held outside during warm weather.			

Developed by R.M. Jones and Mike Owens

Laboratories

	Current Practice	Possible Practice	Not Currently Feasible
1. Do not turn on equipment or burners before they are needed.			
2. Do not purchase materials that must be kept cold or frozen until they are actually needed.			
3. Make sure that refrigeratros and freezers are in good repair and door seals are tight.			
4. Wash equipment with cold water whenever possible.			
5. Do not let water run unnecessarily.			
6. Repair leaky faucets.			
7. Keep water temperature at the lowest possible practical temperature.			
8. Use ventilating fans only when necessary.			

Devleoped by R.M. Jones and Mike Owens

FEDERAL GRANTS AND ENERGY AUDITS
REGION VII ESC CAN HELP

In a period of rapidly escalating utility costs, school districts must avail themselves of every opportunity to initiate energy conservation plans. Title III of the National Energy Conservation Policy Act (NECPA), Pub. L. 95-619 Stat. 3206, provides grants to assist the eligible institutions with buildings occupied prior to April 20, 1977, to do Energy Audits (PEA/EA), Technical Assistance (TA) Analysis and Energy Conservation Measures (ECM's). Such a program is available through a cooperative venture between Region VII Education Service Center and the Texas Energy and Natural Resources Advisory Council (TENRAC). This cooperative venture provides the following services: (1) an opportunity for school districts to receive consultative services; (2) assistance in applying for federal matching grants; (3) assistance in conducting energy audits; and (4) assistance in developing in-house energy conservation plans.

This approach to the Energy Conservation Grants Program consists of the following outline which is provided to illustrate the various components of a comprehensive energy plan for an institution. The outline is not intended to exclude a plan that may be developed to meet the needs of a particular institution; however, each building owner should use this or a similar outline in writing a comprehensive energy plan and applying for federal energy grants.

1. The superintendent discusses the need for an energy management plan with the school trustees.

2. The Board of Trustees passes an energy resolution.

Be it resolved that Township Independent School District Board of Education carry forward policies and plans for the conservation of energy in order to do its part in conserving for the nation's future some part of those irreplaceable natural energy resources. The focus shall be upon energy which can be saved without doing injury to and imposing educational restructions upon students and instructional personnel.

3. The superintendent appoints a district energy coordinator and a district energy management committee.

4. The District Energy Management Committee assesses the current district energy data by:

   (a) completing the Preliminary Energy Audit (PEA) and the Energy Audit (EA)
   (b) recommends an engineer be employed

5. The school completes a Preliminary Energy Audit (PEA) form.

   The Preliminary Energy Audit (PEA) is to provide basic building information which will assist the building owners in identifying buildings with the greatest potential for saving energy.

6. The school completes the Energy Audit (EA) form.

   The Energy Audit (EA) is a more thorough survey of the buildings. It involves the recording of data about the type, size, energy use level, and major energy using systems developing a list of maintenance and operating procedures which could be implemented to conserve energy.

7. The school implements the procedures identified in the Energy Audit (EA).

8. The superintendent presents an energy management outline and the Energy Management Committee M/O suggestions to the trustees.

9. OPTIONAL - The school submits an application to the Texas Energy and Natural Resources Advisory Council (TENRAC) for a Technical Assistance (TA) grant.

10. An engineer conducts the Technical Assistance (TA) analysis.

    The TA consists of a detailed engineering analysis performed by a registered professional engineer. It involves the identification of maintenance and operating procedures to save energy, the collection and analysis of data relating to energy cost savings, payback periods, and projected energy savings resulting from the installation of Energy Conservation Measures (ECM's). The TA report will include recommendations for such energy saving measures as storm windows, insulation, solar energy systems, and automatic controls.

11. The school implements the M/O procedures identified by the engineer.

12. The school submits a grant application to TENRAC for ECM's recommended by the engineer in the TA report form.

    The Energy Conservation Measures (ECM) Grant, provides for the purchase and installation of energy conservation measures including material, equipment, and the physical modification of the building recommended as a result of the TA.

    The ECM Application deadline is June 1 of each year. Schools will be notified in February if their grants are approved. (The grant will not pay for items done prior to notification of grant approval.)

13. The school will puchase and install the Energy Conservation Measures (ECM's).

14. The school will monitor energy savings prior to and subsequent to the installation of Energy Conservation Measures (ECM's).

The Texas Energy and Natural Resources Advisory Council (TENRAC) will evaluate the Technical Assistance and Energy Conservation Measures Grants by analyzing the data and information obtained. The monitoring of activities in relation to Energy Audits (EA), Technical Assistance (TA), and Energy Conservation Measures (ECM) will be accomplished with some on-site auditing in order to observe the results of the program.

An emphasis in encouraging the use of solar energy is an important component of the Energy Conservation Measure (ECM) Grants program. The State will provide the institutions with analyses of their solar energy potential based on the data reported on the Preliminary Energy Audit and Energy Audit forms or will provide the institutions with a procedure they can use to analyze the solar energy potential of their buildings.

An energy management plan is an evolving process. As data is collected and analyzed, the plan should be expanded to include data and procedures recommended as a result of this study. Thus the plan becomes a living document that will assist each board, superintendent, staff and others in conserving energy.